ALTERATIONS TO FACILITY LOCATED AT

202 DELSEA DRIVE, GLASSBORO, NEW JERSEY 08028

PROJECT MANUAL

PROJECT NO. 77174

December 8, 2025

ROWAN UNIVERSITY

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PLANNING AND CONSTRUCTION

ALLOWANCE AUTHORIZATION

Project: _____

_____

Vendor: _____

_____

Allowance Authorization Number: _____

Date: _____

RU Project Number: _____

PO Number: _____

You are authorized to perform the following item(s) of work and to adjust the Allowance Sum accordingly:

This authorization is due to:

☐ Owners Request ☐ Field Condition Requirement ☐ Unforeseen Condition ☐ Design Error/Omission ☐ DCA Request

Explain:

THIS IS NOT A CHANGE ORDER AND DOES NOT INCREASE OR DECREASE THE CONTRACT AMOUNT

Original Allowance..... $
Allowance Expenditures prior to this Authorization ..... $
Allowance Balance prior to this Authorization ..... $
Allowance will be [increased] [decreased] by this Authorization..... $
New Allowance Balance ..... $

APPROVAL RECOMMENDED

_____
Rowan Project Manager Date

_____
VP Administration and Finance Date
(amounts >$30,099.99)

_____
AVP Facilities Date
(amounts > $6,019.99)

☐ Attachments

Copies: ☐ Owner ☐ Contractor ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ File

Revision 1 – October 2010

PLANNING AND CONSTRUCTION

ALLOWANCE CHARGE REQUEST (PROPOSAL)

Project: _____ Allowance Charge Request Number: _____

_____ From (Contractor): _____

To: _____ Date: _____

_____ RU Project Number: _____

Re: _____ PO Number: _____

This Allowance Charge Request contains charges to be made against the contract allowance

Description of Proposed Charge:

Attached supporting information from: ☐ Subcontractor ☐ Supplier ☐ ☐

Reason for Charge:

Attached pages: ☐ Proposal Worksheet Summary:
☐ Proposal Worksheet Details:

Signed by: Date:

Copies: ☐ Owner ☐ Contractor ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ File

Revision 0 – September 2010

Rowan University

Facilities Planning & Construction

REQUEST FOR INFORMATION

RFI No:

Rowan Project No./Description:	Date Submitted:
	Requested Response Date:
	Actual Response Date:
Rowan Project Manager:	
Submitted to:	
Company:	

Contract Document Reference:

RFI DISCUSSION

Individually number each separate topic or question

Submitted by (Name & Company): Title: Date:

RFI RESPONSE

Answered by (Name & Company): Title: Date:

CHANGE ORDER REQUEST

OWNER ☐
ARCHITECT ☐
CONTRACTOR ☐
FIELD ☐
OTHER ☐

PROJECT: (name, address)

CHANGE ORDER REQUEST NUMBER:

DATE OF ISSUANCE:

ARCHITECT'S PROJECT NO:

CONTRACT FOR:

OWNER: (name, address)

CONTRACT DATE:

ARCHITECT: (name, address)

FROM CONTRACTOR: (name, address)

The contractor must submit this proposal with all appropriate documentation and/or notify the Architect or Owner, in writing, of the date on which proposal submission is anticipated.

THIS IS NOT A CHANGE ORDER, A CONSTRUCTION DIRECTIVE OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICTIONS.

DESCRIPTION: (Insert a written description of the Work)

ATTACHMENTS: (List attached documents that support description)

REQUESTED BY THE CONTRACTOR:

(Signature)

(Printed Name and title)

CHANGE ORDER

OWNER ☐
ARCHITECT ☐
CONTRACTOR ☐
FIELD ☐
OTHER ☐

PROJECT:
(name, address)

CHANGE ORDER NUMBER:

DATE:

TO CONTRACTOR:
(name, address)

ARCHITECT'S PROJECT NO:

CONTRACT DATE:

CONTRACT FOR:

PURCHASE ORDER NO:

The Contract is changed as follows:

Not valid until signed by the Owner, Architect and Contractor.

The original (Contract Sum) (Guaranteed Maximum Price) was
New change by previously authorized Change Orders
The (Contract Sum) (Guaranteed Maximum Price) prior to this Change Order was
The (Contract Sum) (Guaranteed Maximum Price) will be (increased) (decreased)
(unchanged) by this Change Order in the amount of
The new (Contract Sum) (Guaranteed Maximum Price) including this Change Order will be

The Contract Time will be (increased) (decreased) (unchanged) by ( ) days. The
date of Substantial Completion as of the date of this Change Order therefore is

NOTE: This summary does not reflect changes in the Contract Sum, Contract Time or Guaranteed Maximum Price which have been authorized by Construction Change Directive.

_____	_____	Rowan University
ARCHITECT	CONTRACTOR	OWNER
_____	_____	201 Mullica Hill Road
Address	Address	Address
_____	_____	Glassboro, NJ 08028-1701
BY_____	BY_____	BY_____
DATE_____	DATE_____	DATE_____

Rowan University

PROJECT NAME

CONTRACTOR

SUBCONTRACTOR

PROJECT NO.

CONTRACT NO.

DATE

HOURLY LABOR RATE BREAKDOWN FORM

All Contractors (Including sub-subcontractors) need to include a detailed breakdown of all wage rates, payroll burden costs and material costs for lump sum and time and material extras. Payroll burden items, FICA, FUI, SUI, and Workmen's Compensation will be reimbursed on an average annualized basis. **This information must be provided for all trade to be utilized on the project by any and all contractors at the time of contractors bid submission.** The required format is as follows:
(Reference 'Change Orders' in AIA 201 General Conditions. Certified payrolls required for all workers on Project.)

TRADE: _____ **CLASSIFICATION:** _____

Item	Benefit Paid	Benefit Provided	Rate Per $100	Prevailing Wage Rate: Regular Time	Overtime	Double Time	Notes
Base Labor Rate							*Use certified payroll to verify.*
	Benefit Paid	Benefit Provided					
Fringe Benefits:	(put X in appropriate box)						
Pension [1]							
Annuity Fund [1]							
Health/Welfare [1]							
Training/Certification [1]							
Vacation [1]							
Paid Holiday [1]							
Associate Dues [1]							
Other [1]							
Fringe Benefits Subtotal							
Total PW Hourly Rate							*= Base Labor Rate + Benefits*
Benefits Paid							
Total Paid Hourly Rate							*= Base Labor Rate + Benefits*
Burden: Taxes & Insurance [2]							
FICA							
Medicare							
Federal Unemployment							
State Unemployment							*Maximum - 0.062.*
Workers Compensation [1]							*Usually less than 11%; can*
Other [1]							
Other [1]							
Burden Subtotal							
Contractor Liability Insurance				N/A	N/A	N/A	*Included in OH&P*
Small Tools				N/A	N/A	N/A	*Included in OH&P*
Other (warranty, record drawings, payment bonds, performance bonds, etc.)				N/A	N/A	N/A	*Included in OH&P*
TOTAL HOURLY RATE (Total Hourly Rate + Burden)							*= Amount Contractor paid to employee*

Note: For change order work, mark-ups for overhead and profit shall be applied to the above rates (these rates are subject to audit) in accordance with the provisions of AIA 201 General Conditions, under 'Change Orders'.

[1] Costs for Overtime and Double Time are same as for Regular Time.

[2] Taxes & Insurance apply to Total Paid Hourly Rate which includes Base Labor Rate plus benefits paid in cash.

By signing below, the submitter certifies and declares under penalty of perjury under the laws of the State of New Jersey that the foregoing is true and correct.

Rates certified by: _____ (print name)

Company Name: _____

Signature: _____

Date: _____

Rowan University

PROJECT NAME	Superiority Hall Renovation Project	PROJECT NO.	RU00000
CONTRACTOR	Cut No Corners Contractors	CONTRACT NO.	PO000000
SUBCONTRACTOR	Don Write Electrical	DATE	1/1/2019

HOURLY LABOR RATE BREAKDOWN FORM

All Contractors (Including sub-subcontractors) need to include a detailed breakdown of all wage rates, payroll burden costs and material costs for lump sum and time and material extras. Payroll burden items, FICA, FUI, SUI, and Workmen's Compensation will be reimbursed on an average annualized basis. **This information must be provided for all trade to be utilized on the project by any and all contractors at the time of contractors bid submission.** The required format is as follows:
(Reference 'Change Orders' in AIA 201 General Conditions. Certified payrolls required for all workers on Project.)

TRADE: Electrical **CLASSIFICATION:** Electrical Forman

Item	Benefit Paid	Benefit Provided	Rate Per $100	Prevailing Wage Rate Regular Time	Overtime	Double Time	Notes
Base Labor Rate				$ 37.40	$ 56.10	$ 74.80	*Use certified payroll to verify.*
	Benefit Paid	Benefit Provided					
Fringe Benefits:	(put X in appropriate box)						
Pension [1]		X		5.65	5.65	5.65	
Annuity Fund [1]		X		-	-	-	
Health/Welfare [1]	X			10.40	10.40	10.40	
Training/Certification [1]	X			0.70	0.70	0.70	
Vacation [1]		X		-	-	-	
Paid Holiday [1]		X		-	-	-	
Associate Dues [1]		X		-	-	-	
Other [1]		X		0.41	0.41	0.41	
Fringe Benefits Subtotal				$ 17.16	$ 17.16	$ 17.16	
Total PW Hourly Rate				$ 54.56	$ 73.26	$ 91.96	*= Base Labor Rate + Benefits*
Benefits Paid				$ 11.10	$ 11.10	$ 11.10	
Total Paid Hourly Rate				$ 48.50	$ 67.20	$ 85.90	*= Base Labor Rate + Benefits*
Burden: Taxes & Insurance [2]							
FICA			0.0620	3.01	4.17	5.33	
Medicare			0.0145	0.70	0.97	1.25	
Federal Unemployment			0.0080	0.39	0.54	0.69	
State Unemployment				-	-	-	*Maximum - 0.062.*
Workers Compensation [1]				-	-	-	*Usually less than 11%; can*
Other [1]				-	-	-	
Other [1]				-	-	-	
Burden Subtotal				$ 4.10	$ 5.68	$ 7.26	
Contractor Liability Insurance				N/A	N/A	N/A	*Included in OH&P*
Small Tools				N/A	N/A	N/A	*Included in OH&P*
Other (warranty, record drawings, payment bonds, performance bonds, etc.)				N/A	N/A	N/A	*Included in OH&P*
TOTAL HOURLY RATE (Total Hourly Rate + Burden)				**$ 58.66**	**$ 78.94**	**$ 99.22**	*= Amount Contractor paid to employee*

Note: For change order work, mark-ups for overhead and profit shall be applied to the above rates (these rates are subject to audit) in accordance with the provisions of AIA 201 General Conditions, under 'Change Orders'.

[1] Costs for Overtime and Double Time are same as for Regular Time.

[2] Taxes & Insurance apply to Total Paid Hourly Rate which includes Base Labor Rate plus benefits paid in cash.

By signing below, the submitter certifies and declares under penalty of perjury under the laws of the State of New Jersey that the foregoing is true and correct.

Rates certified by: Don Write (print name) Company Name: Don Write Electrical

Signature: Don Write Date: 1/1/2019

SAMPLE

DAILY JOB REPORT

Project #

DATE:		
WEATHER CONDITIONS:		
VISITORS:		

CONTRACTORS ON SITE:	***SUPER ON SITE (Y/N):***	**WORKFORCE ON SITE: (Foreman, Tradesmen, Laborers, etc.)**	***NO. OF WORKERS***	***WORK BEING DONE:***

MATERIALS DELIVERED:	***EQUIPMENT ONSITE:***

PROBLEMS/STATUS/CAUSES FOR DELAY:
NOTEWORTHY PHONE CALLS:

APPLICATION AND CERTIFICATE FOR PAYMENT

AIA DOCUMENT G702

TO OWNER:

PROJECT:

APPLICATION NO:

PERIOD TO:

PROJECT/CONTRACT NO:

FROM CONTRACTOR:

VIA ENGINEER:

CONTRACT DATE:

APPLICATION DATE:

CONTRACTOR'S APPLICATION FOR PAYMENT

CHANGE ORDER SUMMARY		
Change Orders approved in ;previous months by owner	ADDITIONS	DEDUCTIONS
TOTAL		
·Approved This Month Number Date Approved		
TOTALS		
INet Change Bv Change Orders		

The undersigned Contractor certifies that to the best of the Contractors knowledge, information and belief the work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

Application is made for Payment, as shown below, in connection with the Contract.

Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM..... _____
2. Net change by Change Orders..... _____
3. CONTRACT SUM TO DATE (LINE 1 + 2)..... _____
4. TOTAL COMPLETED & STORED TO DATE..... _____
   {Column G on 8703)
5. Retainage:
   a. % of Completed Work.._____
      {Column D + E on 8703)
   b. O % of Stored Materials...
      {Columnf on G703} - - - - - - - - - -
   Total Retainage (line Sa + Sb or
   Total in Column I of 8703)..... _____
6. TOTAL EARNED LESS RETAINAGE _____
   {Line 4 less Line 5 Total}
7. LESS PREVIOUS CERTIFICATES FOR
   PAYMENT (Line 6 from prior Certificate)..... _____
8. **CURRENT PAYMENT DUE**..... _____
9. BALANCE TO FINISH, PLUS RETAINAGE .. _____
   {Line 3 less Line 6)

CONTRACTOR:

By: Date:

State County of.

Subscribed and sworn to before me this day of 2010

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, Based on on-site observations and the data comprising the above application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED..... _____ $

{Attach explanation if amount certified differs from the amount applied for.}

ARCHITECT:

By: Date.:_____

This Certificate is not negotiable. THE AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract

CONTINUATION SHEET

A!A Document G702, APPLICATION AND CERTIFICATE FOR PAYMENT, containing Contractor's signed Certification is attached.
In tabulations below, amounts are stated to the nearest dollar
Use Column I on Contracts where variable retainage for line items may apply.

APPLICAT!ON NO:
APPUCATION DATE:
PERIOD TO:
PROJECT NO:

A	B	C			C		D		E			F	G	H	I
									WORK COMPLETED						
eM NO.	ue '-	'''	Oe MEASURE	.. ,-e	VALUE	APPLICATION	Oe MEASURE	TOTAL	COMPLETED THIS PERIOD	Oe MEASURE	TOTAL	'''□ ''''''-'' PRESENTLY STORED NOTIN DORE	COMPLETED ANO STORED TODATE	c,c	T6F1/li1SH C-G

Attachment to G702 (or equivalent)
Certification for Payment

Project Name:_____
Project Number:_____Payment Number:___

I, _____, a prime contractor working for Rowa,n University on the above-mentioned project, hereby certify as required by P.L. 191, c.507 of the State of New Jersey that: **(you must check one under "A" and one under "B")**

A.. With respect to previous progress payments:

( ) all my sub-contractors and suppliers have been paid all amounts due from all previous progress payments I have received from Rowan University for my work on this project

( ) all my sub-contractors and suppliers have been paid all amounts due from all previous progress payments with the exception of those listed below for which payment is being withheld as there exists a valid basis for those sub-contractors and suppliers listed below under the terms of their contract(s) to withhold payment from each such sub-contractor and supplier:

1. _____

2. _____

3. _____

For such sub-contractor and supplier for which payment is being withheld, I further certify that written notice detailing the specific reason(s) for withholding payment has been provided to each such sub-contractor and supplier with copies

thereof provided to my performance bond company and Rowan University.

B. With respect to this payment number_____

( ) all my sub-contractors and suppliers shall be paid all amounts due from this progress payment

( ) all my sub-contractors and suppliers shall be paid all amounts due from this progress payment with the exception of those listed below for which payment will be withheld as there exists a valid basis for those sub-contractors and suppliers listed below under the terms of their contract(s) to withhold payment from each such sub-contractor and supplier:

1. _____

2. _____

3. _____

For each sub-contractor and supplier for which payment is being withheld, I further certify that written notice detailing the specific reason(s) for withholding payment has been provided to each sub-contractor and supplier with copies thereof provided to my performance bond company and Rowan University.

I certify that the above statements are true. I am aware that if any of the above statements are willfully false, I am subject to punishment.

Dated:_____ _____

Signature

_____

Please Print Name

CONTRACTOR'S PARTIAL OR FINAL RELEASE AND WAIVER OF LIENS

OWNER: **CONTRACT FOR:**

OWNER'S AGENT:

PROJECT: **CONTRACT DATE:**

Upon receipt by the undersigned Contractor of a check from Owner in the sum of $_____, which check will consume payment of all sums due the Contractor for labor, equipment and/or materials supplied in connection with the Project, and when said check has been paid by the bank upon which it is drawn, this document shall become effective to fully and finally waive and release any and all liens, claims, liabilities, actions, and demands that this Contractor and all its subcontractors have or might have against Owner, Lender, the Project, the real property upon which the Project is located and any and all other property owned by Owner on account of or in connection with labor, equipment and/or materials supplied by the undersigned to the Project.

The undersigned Contractor does hereby further acknowledge and represent that through the date hereof the undersigned has received payments totaling $_____ for labor, equipment and/or materials supplied to the Project.

This instrument has been executed as of the _____day of _____, 20__.

CONTRACTOR:

_____

By: _____

Name: _____

Title: _____

STATE OF _____ δ
δ
COUNTY OF _____ δ

Sworn to and subscribed before me the undersigned authority on this _____ day of _____, 20__.

[S E A L]

_____
Notary Public, State of _____

My Commission Expires:

_____

_____
Printed Name of Notary Public

Rowan University

To Whom It May Concern:

Your recent request to Rowan University requesting information or a tax exempt form is hereby acknowledged.

It has been determined that Rowan University is a government body and is Exempt from New Jersey Sales and Use Taxes imposed by the Sales and Use Tax Act (P.L. 1966, c.30 and c.52). An opinion from the State of New Jersey, Office of the Attorney General has been reproduced below.

If you have any questions, please contact the Accounts Payable Office at (856) 256-4115.

Sincerely,

Joseph F. Scully, Jr.
Vice President for Finance & CFO

State of New Jersey

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

OFFICE OF THE ATTORNEY GENERAL
DEPARTMENT OF LAW AND PUBLIC SAFETY
DIVISION OF LAW
25 MARKET STREET
PO Box 112
TRENTON, NJ 08625-0112

PAULA T. DOW
Attorney General

ROBERT M. HANNA
Director

May 4, 2011

Joseph F. Scully, Jr.
Vice President for Finance & CFO
Rowan University
Bole Hall
201 Mullica Hill Road
Glassboro, NJ 08028-1701

Re: Tax Exempt Status of Rowan University
Federal Tax ID #222-764-819

Dear Mr. Scully:

You have asked this office for an opinion whether Rowan University is obligated to pay New Jersey sales and use taxes in the conduct of the University's business.

You are hereby advised that, pursuant to N.J.S.A. 54:32B-9, any sales, service or amusement charge by or to the University or any use or occupancy by the University is not subject to taxes imposed by the New Jersey Sales and Use Tax Act, N.J.S.A. 54:32B-1 et seq., where the University or its authorized representative conducting University business, is the purchaser, user or consumer. Further, should the United States or any other state grant an exemption from certain taxes to the State of New Jersey, Rowan University, as an arm of the State, is entitled to such consideration.

Sincerely yours,

PAULA T. DOW
ATTORNEY GENERAL OF NEW JERSEY

By: Cheryl R. Clarke
Cheryl R. Clarke
Deputy Attorney General

CRC/rd

HUGHES JUSTICE COMPLEX • TELEPHONE: (609) 292-8572 • FAX: (609) 943-5853
New Jersey Is An Equal Opportunity Employer • Printed on Recycled Paper and Recyclable

Chief Financial Officer
Bole Hall
201 Mullica Hill Road
Glassboro, NJ 08028-1701

856-256-4127
856-256-4443 fax

CONSENT OF SURETY COMPANY TO FINAL PAYMENT

AIA DOCUMENT G707

OWNER ☐
ARCHITECT ☐
CONTRACTOR ☐
SURETY ☐
OTHER

PROJECT:
(name, address)

TO (Owner)

ARCHITECT'S PROJECT NO:

CONTRACT FOR:

CONTRACT DATE:

CONTRACTOR:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the (there insert name and address of Surety Company)

, SURETY COMPANY,

on bond of (there insert name and address of Contractor)

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety Company of any of its obligations to (there insert name and address of Owner)

, OWNER,

as set forth in the said Surety Company's bond.

IN WITNESS WHEREOF,
the Surety Company has hereunto set its hand this day of 2017

Surety Company

Signature of Authorized Representative

Attest:
(Seal):

Title

NOTE: This form is to be used as a companion document to AIA DOCUMENT G706, CONTRACTOR'S AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS, Current Edition

PRE-RENOVATION HAZARDOUS MATERIALS SURVEY

Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

PREPARED FOR:
Rowan University
201 Mullica Hill Road
Glassboro, New Jersey 08028

PREPARED BY:
Montrose Environmental, Inc.
500 Horizon Drive, Suite 540
Robbinsville, NJ 08691

MONTROSE PROJECT NO. 1200-42

MONTROSE ENVIRONMENTAL

September 2022

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EXECUTIVE SUMMARY

From July 28, 2022 through August 18, 2022, Montrose Environmental, Inc. (Montrose) conducted a Pre-Renovation Hazardous Materials Survey (hereinafter the "Survey") of Glassboro Intermediate School located at 202 Delsea Drive in Glassboro, New Jersey (hereinafter the "Site"). The objective of the Survey was to conduct a comprehensive asbestos-containing materials (ACM) survey of Site, alongside a lead-based paint (LBP) x-ray fluorescence (XRF) screening, as appropriate. The Site consists of the Glassboro Intermediate School itself, an outbuilding slated for demolition arbitrarily called the "Demo House," two club houses, and the Industrial Arts Building. This report concerns the Glassboro Intermediate School, with the remainder presented under separate cover.

The Glassboro Intermediate School was constructed in 1930, and is a three-story structure over a full basement, with concrete and brick exteriors and a mixture of pitched and flat roofing systems. Interior partitions consist of cinder block, brick, plaster, and drywall. Sampling of the roofing materials was included as part of this Survey.

SUMMARY OF FINDINGS

Asbestos

Asbestos-containing materials were identified throughout Glassboro Intermediate School, with a summary provided in **Table 1**. Representative photographs of sampled materials are provided in **Appendix B**. A location map of confirmed ACM is provided in **Figures 1 through 4**, with a roof area depiction map provided in **Figures 5 and 6.** Laboratory reports are provided in **Appendix D.**

Lead-Based Paint Screening

Lead-based paint was throughout Glassboro Intermediate School, with a summary of the XRF screening provided in **Table 2.** Paint chip sample results are provided in **Table 3.** Representative photographs of sampled materials are provided in **Appendix C**. Laboratory reports are provided in **Appendix D**.

CONCLUSIONS AND RECOMMENDATIONS

ACM is present at the Property at the locations identified above. Those materials that will be subject to demolition or renovation must be removed from the subject area prior to the commencement of such activities in accordance with the requirements of N.J.A.C. 5:23-8. The disposal requirements of major sources of ACM include restrictions on visible emissions, provisions for wetting the ACM, packaging, sealing, labeling, record keeping and reporting in accordance with 40 C.F.R 61.150.

LBP was identified throughout the Site, on original components, which included various door components, plaster and brick walls, stairwell components, window components, and wall trim.

Most LBP that was identified in the Survey was found in 'Intact' condition. No further action is necessary with regards to intact LBP at this time. However, a periodic surveillance program should be implemented to verify and maintain the integrity of the LBP. Periodic surveillance can include employment of interim control methods such as paint film stabilization or enclosure/encapsulation of the LBP. Lead safe work practices should be employed should any of these areas undergo renovation in the future.

1.0 INTRODUCTION

From July 28, 2022 through August 18, 2022, Montrose Environmental, Inc. (Montrose) conducted a Pre-Renovation Hazardous Materials Survey (hereinafter the "Survey") of Glassboro Intermediate School located at 202 Delsea Drive in Glassboro, New Jersey (hereinafter the "Site"). The objective of the Survey was to conduct a comprehensive asbestos-containing materials (ACM) survey of Site, alongside a lead-based paint (LBP) x-ray fluorescence (XRF) survey, as appropriate. The Site consists of the Glassboro Intermediate School itself, an outbuilding slated for demolition arbitrarily called the "Demo House," two club houses, and the Industrial Arts Building. This report concerns the Glassboro Intermediate School, with the remainder presented under separate cover.

The Glassboro Intermediate School was constructed in 1930, and is a three-story structure over a full basement, with concrete and brick exteriors and a mixture of pitched and flat roofing systems. Interior partitions consist of cinder block, brick, plaster, and drywall. Sampling of the roofing materials was included as part of this Survey.

The Survey was completed by Mr. Julian Fernandez-Obregon, Ms. Marissa Weinstein, and Mr. Collin Oriente of Montrose. Mr. Fernandez-Obregon, Ms. Weinstein, and Mr. Oriente are certified Asbestos Hazard Emergency Response Act (AHERA) asbestos inspectors. Mr. Fernandez-Obregon and Ms. Weinstein are also New Jersey Department of Health (NJDOH) Lead Inspectors and Risk Assessors. A copy of relevant certifications are included in **Appendix A**.

The United States Environmental Protection Agency (USEPA) defines an ACM as a material that contains greater than one percent (> 1%) asbestos). The purpose of the ACM Survey was to determine the presence of suspect materials at the Property, sample and test the suspect materials, summarize the findings, and propose additional services that may be needed to comply with current National Emission Standards for Hazardous Air Pollutants (NESHAP), Occupational Safety and Health Administration (OSHA), New Jersey Department of Health (NJDOH), and USEPA regulations prior to the renovation of the Property.

The USEPA and the New Jersey Department of Community Affairs (NJDCA) New Jersey Lead Hazard Evaluation and Abatement Code (N.J.A.C. 5:17) consider painted surfaces containing lead at a concentration of 1.0 milligram per square centimeter (mg/cm^2) or 0.5% by weight or greater to be LBP. Montrose conducted paint chip testing to assess whether LBP was present at levels exceeding the USEPA and NJDCA Lead Hazard Evaluation and Abatement Code.

2.0 METHODOLOGY

2.1 ASBESTOS - CONTAINING MATERIALS (ACM)

From July 28, 2022 through August 18, 2022, Montrose conducted an asbestos survey of the Glassboro Intermediate School. ACM sampling followed USEPA sampling protocols. Collection techniques followed best practices as per USEPA and the AHERA guidelines.

Suspect materials were divided into homogeneous areas, which are building materials evaluated by the inspector to be the same based on their color, texture, and age. Representative samples were collected of each homogeneous material. Suspect materials identified and sampled are listed in **Table 1**.

Bulk samples of suspect materials were collected in 4-mil plastic bags and sealed for transport to the laboratory under chain-of-custody protocols. Each sample was assigned a unique homogeneous application number (M-1 through M-15) and sample identification number (e.g., 8A-1).

The following are the homogeneous material symbols used for identification in this report:

T = Thermal System Insulation
M = Miscellaneous Materials
S = Surfacing Materials (troweled or spray-applied)

<u>Surfacing Materials – S (Plaster, Spray-on or Troweled-on Materials, etc.)</u>

1. At least three bulk samples were collected from each homogeneous area that was 1,000 ft^2 or less.
2. At least five bulk samples were collected from each homogeneous area that was greater than 1,000 ft^2 but less than or equal to 5,000 ft^2.
3. At least seven bulk samples were collected from each homogeneous area that was greater than 5,000 ft^2.

<u>Thermal system insulation – T (Pipe Insulation, Elbows, Boiler Systems, etc.)</u>

1. At least three bulk samples were collected from each homogeneous area of thermal system insulation.
2. Sufficient samples shall be collected from elbows and fittings to determine if it contains ACM.
3. Bulk samples were not collected from any homogeneous area where the State licensed asbestos inspector determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-suspect material.

<u>Miscellaneous Materials – M (Floor Tiles, Mastics, Vinyl Sheeting, etc.)</u>

1. At least one bulk sample was collected from each homogeneous area that was less than 100 ft^2.
2. At least three bulk samples were collected from each homogeneous area that was greater than 100 ft^2.

2.2 LEAD BASED PAINT SURVEY APPROACH

From July 28, 2022, through August 18, 2022, Montrose also collected representative paint chip samples of interior and exterior surfaces that may be impacted by the planned demolition activities.

Montrose collected representative "readings" of presumed lead-containing paint using an XRF device to test for the presence of lead in paint. The XRF used for the evaluation was a Thermo Niton XL3t 800, Serial #114589. XRF sample results are provided in **Table 2**. Chip sample results are provided in **Table 3**.

3.0 ANALYTICAL METHODS

3.1 Asbestos-Containing Materials

Material identification was performed via Polarized Light Microscopy with Dispersion Staining (PLM/DS) in accordance with New Jersey requirements (N.J.A.C. 8:60 and 12:120) using USEPA Method 600/R-93/116 and for Transmission Electron Microscopy (TEM) analysis using USEPA Method 600/R-93/116B Section 2.5.5.1.

For those materials yielding less than 1% asbestos using PLM, Transmission Electron Microscopy (TEM) analysis was performed for confirmation. Laboratory analysis was conducted by EMSL Analytical located in Cinnaminson, New Jersey. EMSL is certified by the National Institute of Standards and Technology and National Voluntary Laboratory Accreditation Program (NIST-NVLAP # 101048) for asbestos analysis. EMSL's certifications are provided in Appendix A.

3.2 Lead-Based Paint

Paint chip sampling was conducted throughout the Site. Paint chip samples were analyzed by EMSL for lead by flame atomic absorption spectroscopy (AAS) via method SW846 3050B/7000B. EMSL is certified by the American Industrial Hygiene Association Environmental Lead Laboratory Accreditation Program (AIHA ELLAP #100194).

XRF calibration and actual readings were taken using the Quantify Lead Paint mode. The calibration of the instrument was performed in accordance with the specifications for this instrument. The instrument was calibrated using the paint film nearest 1.0 mg/cm^2 in the National Institute of Standard & Technology (NIST) Standard Reference Material (e.g., for NIST SRM 2573, 1.2 mg/cm 2 would be used for color code Red and for NIST SRM 2570, <0.001 mg/cm2 would be used for color code White). Three calibration readings were taken before and after the testing to insure manufacturer standards were met.

4.0 RESULTS

4.1 Asbestos-Containing Materials (ACM)

Montrose collected a total of 501 samples of suspect containing materials within the Site, with additional samples analyzed due to layering of samples collected, with **Table 1** summarizing the sampling results.

Based on the laboratory analysis, **ACM was identified** within the Glassboro Intermediate School and includes the following:

Glassboro Intermediate School – Interior

- M-17 Brown/Tan 9"x9" Floor Tile – Third Floor
- M-37 Black Glue Tar – Stair Treads in Stairwells
- M-143 Brown 9"x9" Floor Tile – Basement
- M-144 Mastic Associated with M143 – Basement
- P-1 Pipe Insulation / Elbows – Presumed Behind Fixed Walls*
- P-2 Wire Insulation – Observed in Walls*

Glassboro Intermediate School – Roof

- M-07 Roofing Tar – Roof 1 Middle Ledge
- M-08 Copper Flashing Mastic – Roof 1 Upper Left
- M-09A Sealant – Roof 1 Upper Left
- M-09B Tar – Roof 1 Upper Left
- M-11 White Caulk – Roof 1 Lower Left
- M-13 Black Caulk – Roof 2 Lower Right
- M-14F Roof Core – Tar Felt – Roof 2 Upper Right
- M-14G Roof Core – Tar Paper – Roof 2 Upper Right
- M-15 Black Mastic – Roof 2 Upper Right
- M-16 Black Tar Sealant – Roof 2 Upper Left

* Pipe insulation and elbows and wire insulation are presumed-asbestos containing, located behind fixed walls, given the age of the building. All exposed pipe insulation throughout the school was verified to be fiberglass, and not suspect ACM. Wire insulation was visible in a single area, but may be present behind fixed walls as well. The wire was potentially live, so was not sampled.

Sample locations are depicted on **Figures 1 to 4**, with a roof map provided in **Figures 5 and 6**, noting all of the different roofing designations. Representative photographs of sampled materials are depicted in **Appendix B**. Laboratory reports are provided in **Appendix D**.

4.2 Lead-Based Paint

Montrose performed LBP testing of representative interior and exterior painted surfaces at the Site. A lead reading by the XRF of 1.0 mg/cm^2 or greater is considered positive for the presence of LBP in accordance with the Lead Hazard Evaluation and Abatement Code (N.J.A.C. 5:17). XRF results for the building and locations are presented in **Table 2**. Chip Sample Results are provided in **Table 3.**

A total of 773 XRF readings were taken from suspect LBP components throughout Glassboro Intermediate School.

Results and locations of paint chip samples taken and analyzed are presented in **Table 3**. Representative photos of LBP are presented in **Appendix C**. Results of analysis and chains of custody are included in **Appendix D**.

Identified LBP Surfaces

LBP in amounts equal to or exceeding the USEPA and/or Lead Hazard Evaluation and Abatement Code criteria of 1.0 mg/cm^2 was found on the following painted substrates:

- Exterior – Doors and Door Frames, inclusive of decorative components
- Stairwells – All Components (Railing, Riser, Stringer, Bannister)
- Throughout – Original Brick, Concrete, & Plaster Walls (few)
- Throughout – Original Baseboards
- Throughout – Window Frames, Sills, and Sashes
- Throughout – Original Door Frames and Jambs
- Throughout – Original Archways and Trim

The above substrates are brick, wood, plaster, and concrete. Confirmatory paint chip samples were collected from areas where XRF testing was conducted and were submitted to EMSL for lead analysis to verify XRF readings. All paint chip samples collected from surfaces with negative XRF readings were determined to contain lead concentrations less than the USEPA definition of >0.5%/wt. All paint chip samples collected from surfaces with positive XRF readings were determined to contain lead concentrations greater than the USEPA definition of >0.5%/wt.

Most plaster walls were negative via XRF for LBP, but any impact to concrete or brick walls should be presumed to be LBP for upcoming renovations. All original wood components, doors, windows, baseboards, trim, etc., should be presumed to be LBP, and lead safe work practices be implemented when impacting those materials. A summary of the Lead in Construction standard, 29 CFR 1926.62 is provided in **Appendix E**.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Asbestos-Containing Materials

ACM is present throughout Glassboro Intermediate School, on those materials noted above and in **Table 1**. Those materials that will be subject to demolition or renovation must be removed from the subject area prior to the commencement of such activities in accordance with the requirements of N.J.A.C. 5:23-8. The disposal requirements of major sources of ACM include restrictions on visible emissions, provisions for wetting the ACM, packaging, sealing, labeling, record keeping and reporting in accordance with 40 C.F.R 61.150.

Pipe insulation and elbows and wire insulation are presumed-asbestos containing, located behind fixed walls, given the age of the building. All exposed pipe insulation throughout the school was verified to be fiberglass, and not suspect ACM. Wire insulation was visible in a single area, but may be present behind fixed walls as well. The wire was potentially live, so was not sampled. If future renovations expose fixed wall cavities containing pipe insulation, elbows, or wire insulation, those materials should be tested prior to removal or impact.

Lead-Based Paint

XRF testing indicated there were LBP surfaces throughout Glassboro Intermediate School, mostly on original wood, plaster, brick, or concrete surfaces, with a summary for XRF testing presented in **Table 2**, and paint chip testing presented in **Table 3**.

Lead-safe work practices and worker/occupant protection practices complying with current USEPA and Occupational Safety and Health Administration (OSHA) standards will be necessary to safely complete all work involving the disturbance of LBP coated surfaces and components. In addition, any work considered lead hazard control will enlist the use of interim control (temporary) methods and/or abatement (permanent) methods. It should be noted that all lead hazard control activities have the potential of creating additional hazards, or even creating hazards that were not present before. All persons and/or firms performing lead hazard control activities must have received proper training in Lead-Safe Work Practices and/or Lead Abatement. Details for the listed lead hazard control options and issues surrounding occupant/worker protection practices can be found in the publication titled: *Guidelines for the Evaluation and Control of LBP Hazards in Housing (Second Edition, July 2012)* (HUD Guidelines), published by HUD, as well as in the OSHA regulations found in 29 CPR, Part 1926.62, known as the OSHA Lead Exposure in Construction Industry Standard. A summary of the standard is provided in **Appendix E**.

Based on the findings of the Assessment, Montrose recommends the following action be implemented to minimize the potential exposure to LBP:

Interim Control:

Interim controls are measures designed to temporarily reduce human exposure or possible exposure to lead-based paint hazards. The recommended interim control measures include:

- Paint film stabilization (paint the LBP with a coat of lead-free paint); and/or
- Enclosure or encapsulation.

Interim control measures should be employed for the identified intact LBP surfaces identified during the Survey.

Permanent Control (Abatement):
Abatement is a measure or measures designed to permanently eliminate the LBP hazard. The recommended permanent control measures include:

- Paint removal by a heat gun, chemical or contained abrasive; and/or
- Removal and replacement of LBP building components.
- Abatement of the lead dust hazard via wet wiping and High Efficiency Particulate Air (HEPA) vacuum techniques.

Most of the LBP identified in Glassboro Intermediate School is in intact condition. Montrose recommends interim controls be implemented for intact LBP, including periodic surveillance, to verify the condition of the LBP. As an alternative to *Interim Controls*, an LBP abatement also can be performed on the intact LBP surfaces. If permanent control is the selected remedial option, then a NJ certified Lead Inspector/ Risk Assessor should be retained to collect wipe samples in the affected areas to verify that a lead dust hazard has not been created during the removal activities. Lead safe work practices should be employed should any of these areas undergo renovation in the future.

-o.0.o-

These results represent the conditions and concentrations present at the time of this survey.

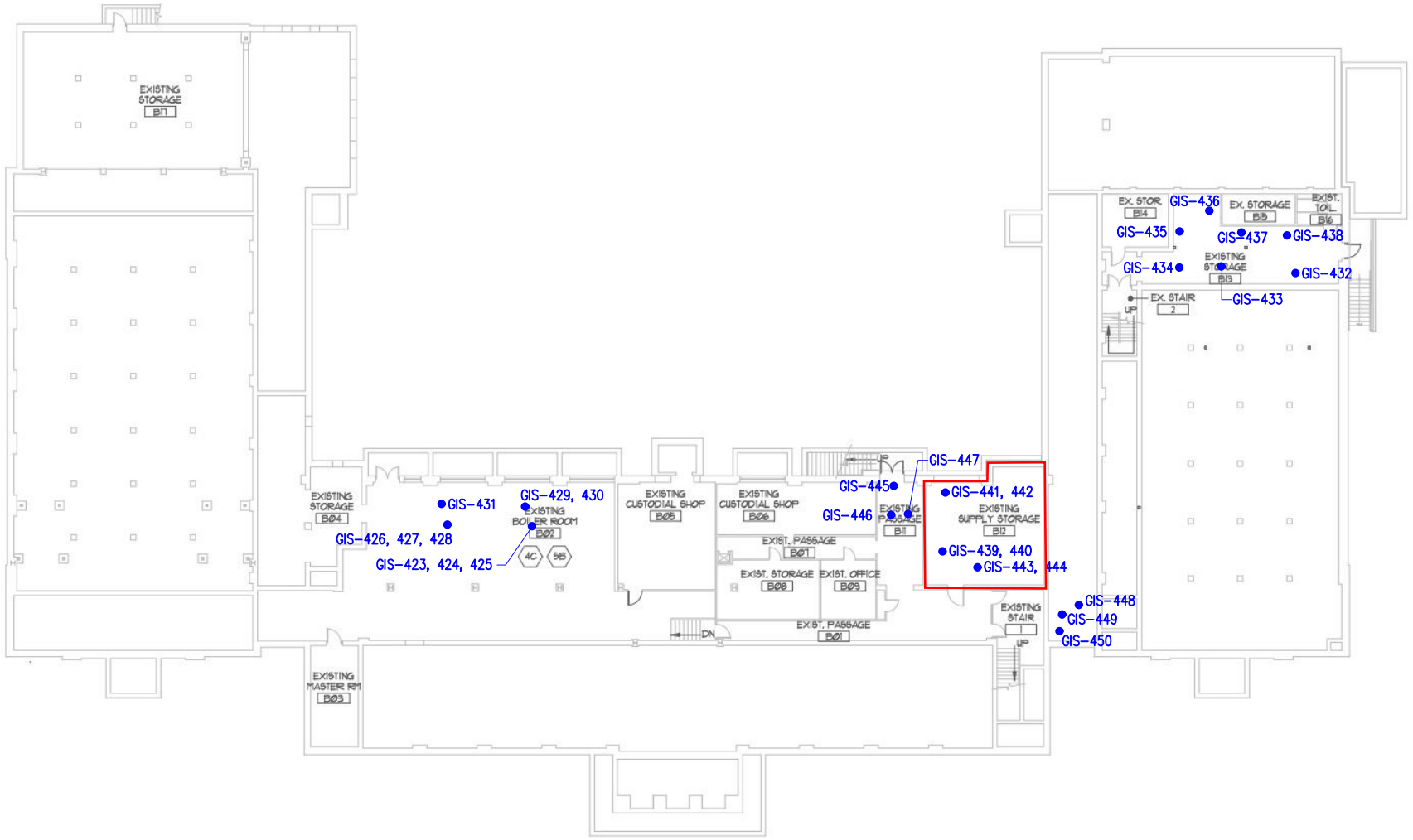
Respectfully Submitted,

MONTROSE ENVIRONMENTAL, INC.

Marissa Weinstein
Staff Health & Safety Specialist

Julian Fernandez-Obregon
Director, Health & Safety Services
Senior Health & Safety Specialist

FIGURES



Basement

Legend

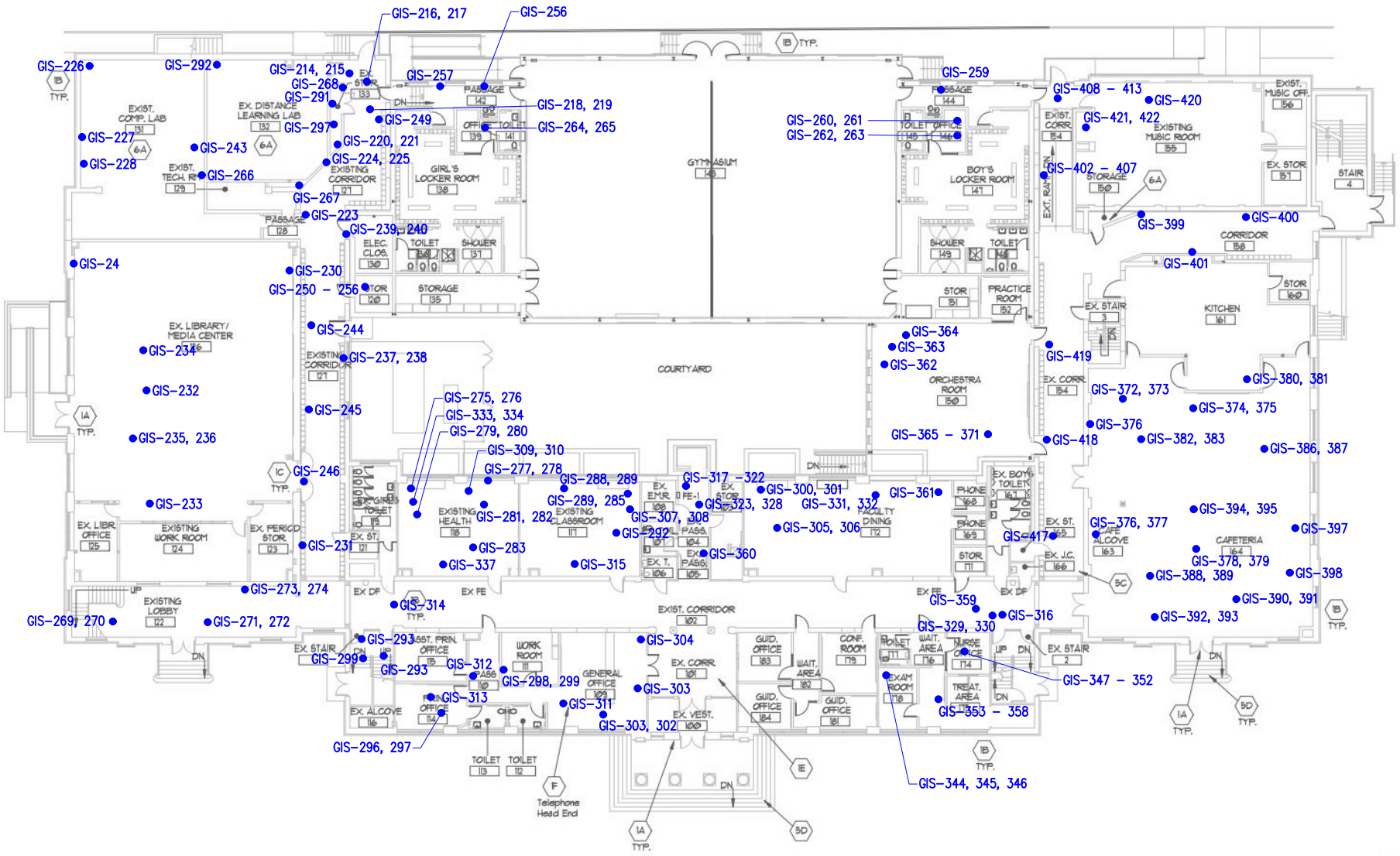
= Sample Location

= Confirmed ACM Location (See Table 1)

DRN: MN	APR: JFO
DATE: 9/14/22	PN: 1200-42

Figure 1
Site Location Map
Glassboro Intermediate School
Glassboro, NJ

MONTROSE ENVIRONMENTAL



First Floor

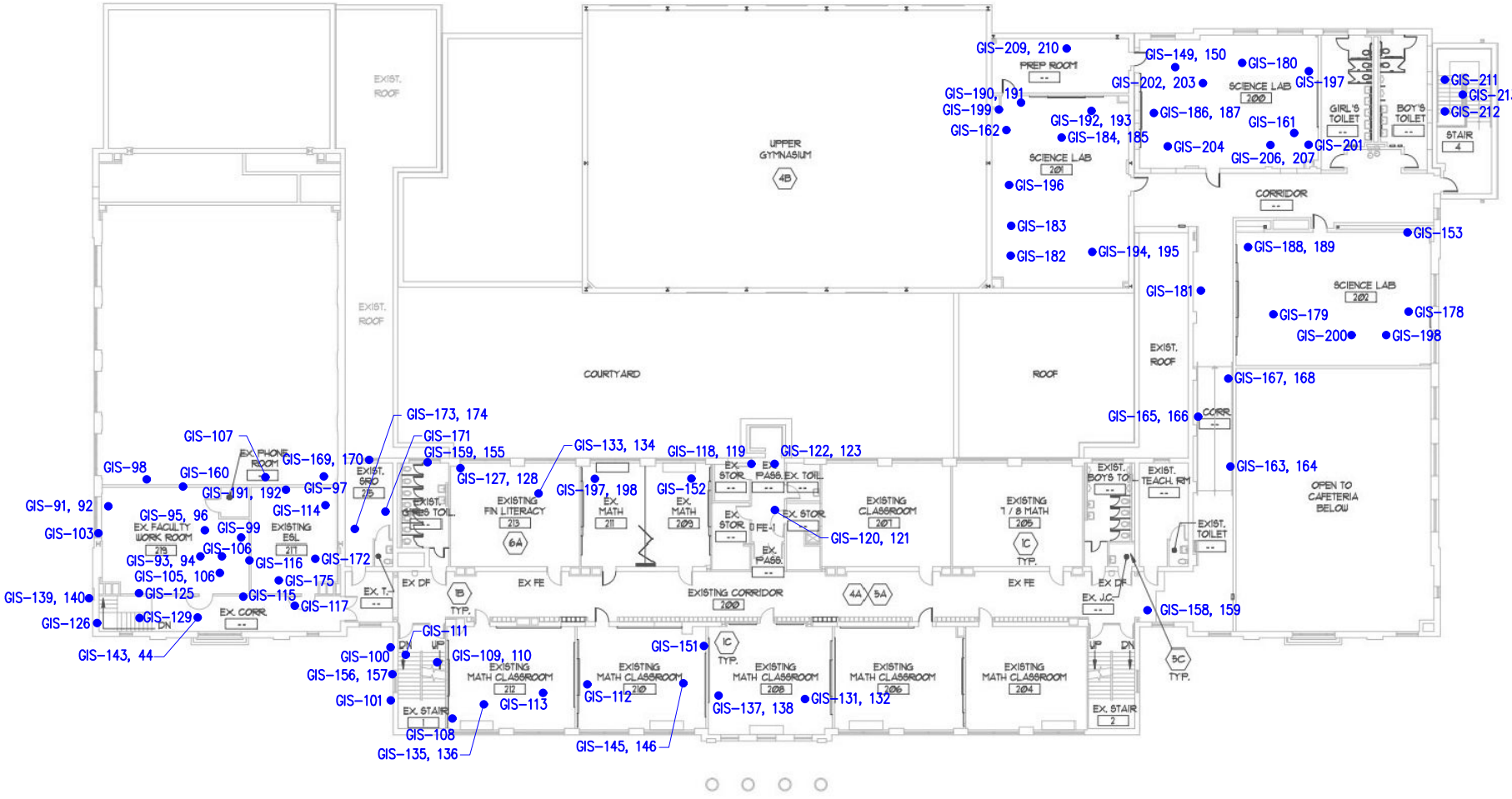
Legend

● = Sample Location

DRN: MN	APR: JFO
DATE: 9/14/22	PN: 1200-42

Figure 2
Sample Location Map
Glassboro Intermediate School
Glassboro, NJ

MONTROSE ENVIRONMENTAL



Second Floor

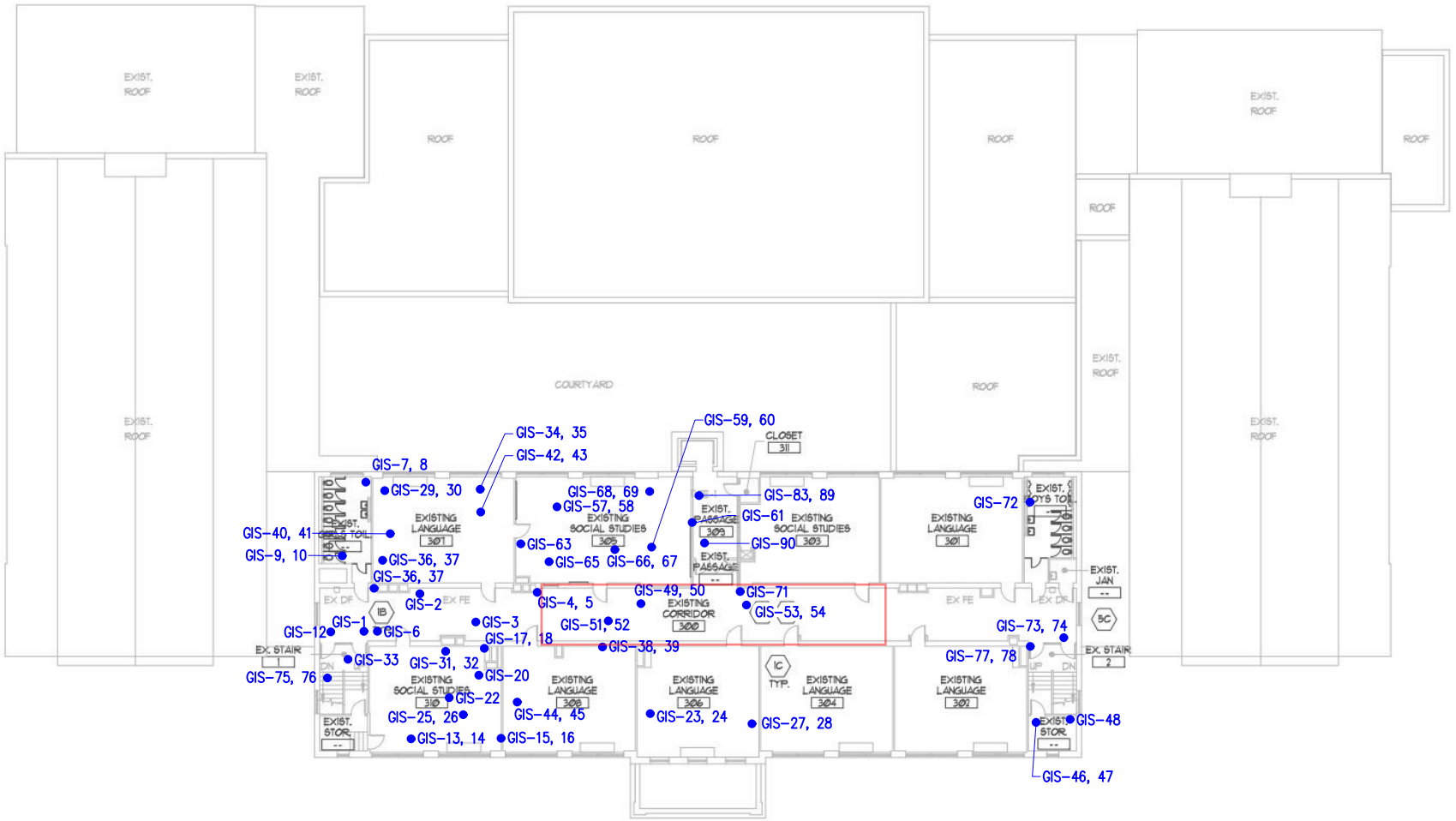
Legend

● = Sample Location

DRN: MN	APR: JFO
DATE: 9/14/22	PN: 1200-42

Figure 3
Sample Location Map
Glassboro Intermediate School
Glassboro, NJ

MONTROSE ENVIRONMENTAL



Third Floor

Legend

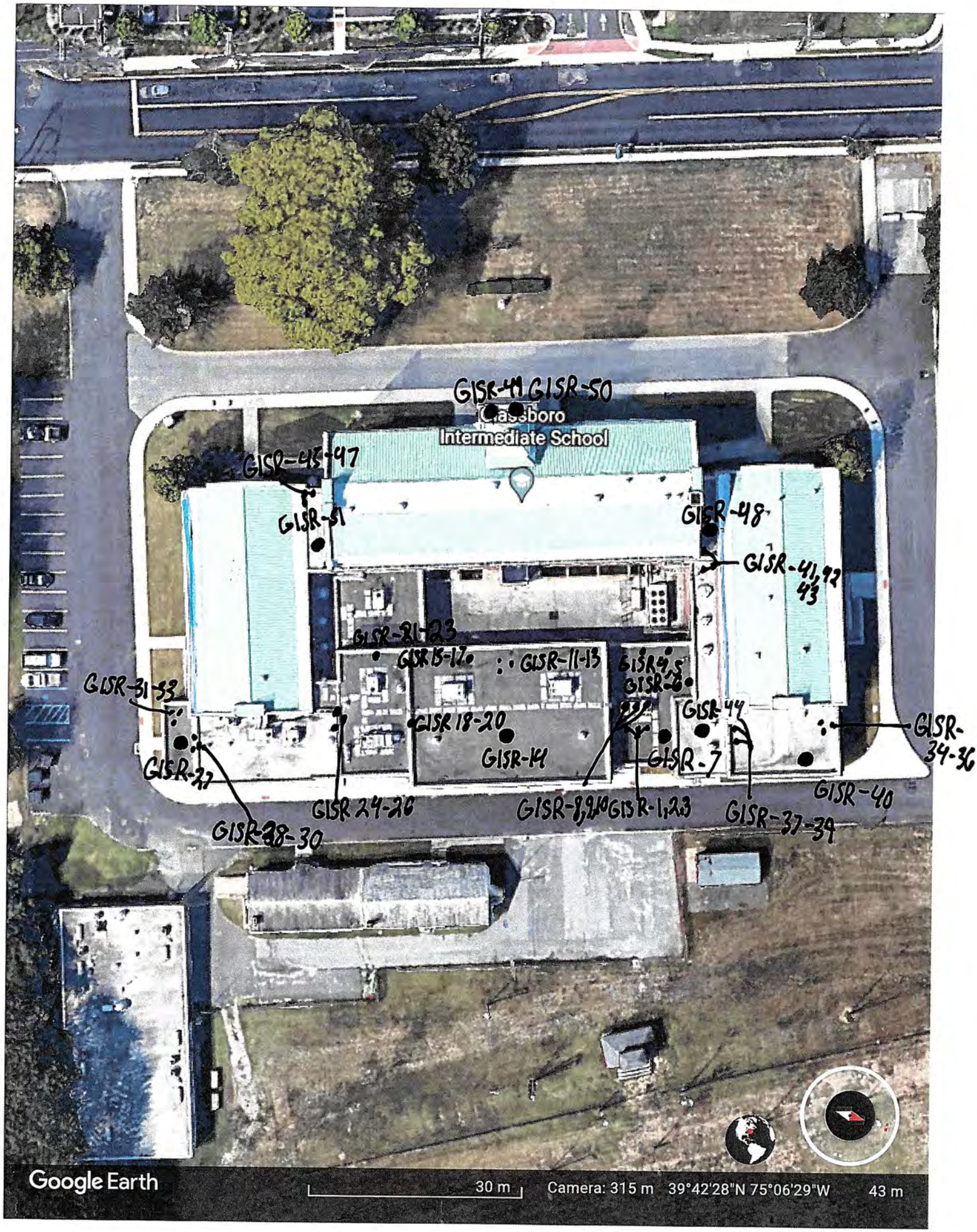
● = Sample Location

◇ = Confirmed ACM Location (See Table 1)

DRN: MN	APR: JFO
DATE: 9/14/22	PN: 1200-42

Figure 4
Sample Location Map
Glassboro Intermediate School
Glassboro, NJ

MONTROSE ENVIRONMENTAL


GISR-49 GISR-50
Glassboro
Intermediate School
GISR-45-47
GISR-51
GISR-48
GISR-41, 42
43
GISR-21-23
GISR 15-17
GISR-11-13
GISR 4-5
GISR-6
GISR-31-33
GISR 18-20
GISR-44
GISR-14
GISR-7
GISR-34-36
GISR-27
GISR 24-26
GISR-8, 10
GISR-1, 2, 3
GISR-37-39
GISR-40
GISR-28-30
Google Earth
30 m
Camera: 315 m 39°42'28"N 75°06'29"W
43 m

LEGEND

ROOF 1

LOWER RIGHT =

MIDDLE =

UPPER LEFT =

LOWER LEFT =

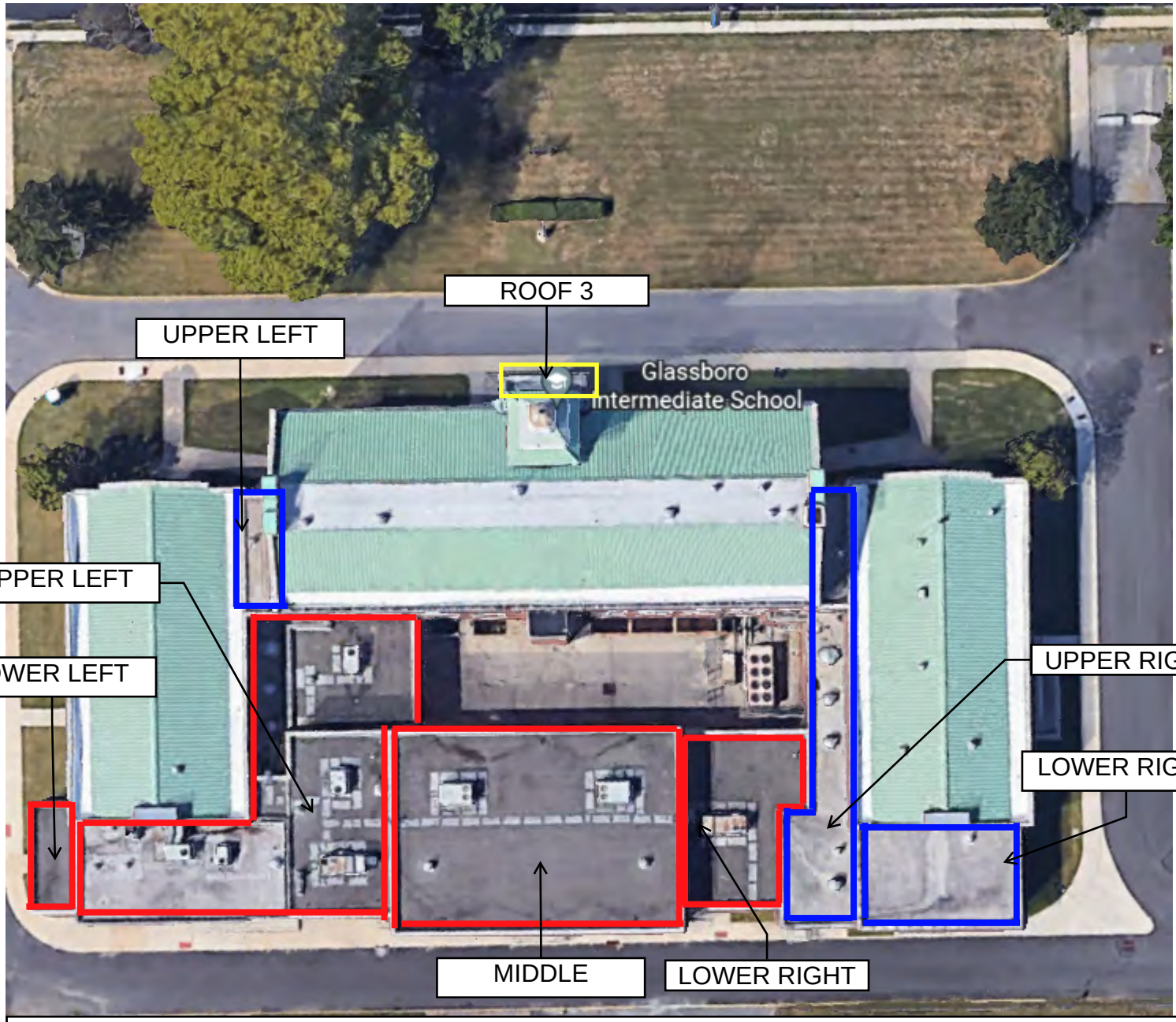
ROOF 2

LOWER RIGHT =

UPPER RIGHT =

UPPER LEFT =

ROOF 3 =



LEGEND

ROOF 1 =

ROOF 2 =

ROOF 3 =

TABLE 1

Asbestos Homogenous Application Table

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
Main Building						
M-01	Pinhole Ceiling Tile	Third Floor Hallway	Good	16000 SF	GIS-1 GIS-2 GIS-3	NAD NAD NAD
M-02	Plaster Joint Compound	Third Floor Hallway	Damaged	1 SF	GIS-4 GIS-5 GIS-6	NAD NAD NAD
S-03	White Plaster	Third Floor	Damaged	35000 SF	GIS-7 GIS-9 GIS-11	NAD NAD NAD
S-04	Brown Plaster	Third Floor	Damaged	35000 SF	GIS-8 GIS-10 GIS-12	NAD NAD NAD
M-05	Green Baseboard	Third Floor Rooms	Damaged	750 LF	GIS-13 GIS-15 GIS-17	NAD* NAD NAD
M-06	Mastic Associated with M-5	Third Floor Rooms	Damaged	750 LF	GIS-14 GIS-16 GIS-18	NAD* NAD NAD
M-07	Green with Specks 12"x12" Floor Tile	Third Floor Rooms	Good	1860 SF	GIS-19 GIS-21 GIS-23	NAD* NAD NAD
M-08	Mastic Associated with M-7	Third Floor Rooms	Good	1860 SF	GIS-20 GIS-22 GIS-24	NAD* NAD NAD
M-09	Gray with Specks 12"x12" Floor Tile	Third Floor Rooms	Good	5000 SF	GIS-25 GIS-27 GIS-29	NAD* NAD NAD
M-10	Mastic Associated with M-9	Third Floor Rooms	Good	5000 SF	GIS-26 GIS-28 GIS-30	NAD NAD* NAD
M-11A	Patch Compound, Lab Split	Third Floor Room 310 and North Stairs	Damaged	250 SF	GIS-31A GIS-32A GIS-33A	NAD NAD NAD
M-11B	Patch Compound, Base Coat, Lab Split	Third Floor Room 310 and North Stairs	Damaged	5 SF	GIS-31B GIS-32B GIS-33B	NAD NAD NAD
M-12	Blue Baseboard	Third Floor Rooms 307 and 308	Good	750 LF	GIS-34 GIS-36 GIS-38	NAD* NAD NAD
M-13	Mastic Associated with M-12	Third Floor Rooms 307 and 308	Good	750 LF	GIS-35 GIS-37 GIS-39	NAD* NAD NAD

MONTROSE ENVIRONMENTAL

Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-14	Blue with Specks 12"x12" Floor Tile	Third Floor Rooms 307 and 308	Good	2000 SF	GIS-40 GIS-42 GIS-44	NAD* NAD NAD
M-15	Mastic Associated with M-14	Third Floor Rooms 307 and 308	Good	2000 SF	GIS-41 GIS-43 GIS-45	NAD* NAD NAD
M-16	Burgandy Fire Caulk	Third Floor North Stairs	Good	50 LF	GIS-46 GIS-47 GIS-48	NAD* NAD NAD
M-17	**Brown/Tan 9"x9" Floor Tile**	**Third Floor Hallway**	**Damaged**	**720 SF**	**GIS-49 GIS-51 GIS-53**	**5.0% Chrysotile 5.3% Chrysotile 5.9% Chrysotile**
M-18	Mastic associated with M-17	Third Floor Hallway	Damaged	720 SF	GIS-50 GIS-52 GIS-54	<0.1 Chrysotile* Insufficient Material Insufficient Material
M-19	Dark Blue 12"x12" Floor Tile	Third Floor Room 305	Good	796 SF	GIS-55 GIS-57 GIS-59	<0.1 Chrysotile* NAD NAD
M-20	Mastic Associated with M-19	Third Floor Room 305	Good	796 SF	GIS-56 GIS-58 GIS-60	NAD* NAD NAD
M-21	Drywall	Third Floor Room 305	Good	35000 SF	GIS-61 GIS-62 GIS-63	NAD NAD NAD
M-22	White with Gray Spots 12"x12" Floor Tile	Third Floor Room 305	Good	1580 SF	GIS-64 GIS-66 GIS-68	NAD* NAD NAD
M-23	Mastic Associated with M-22	Third Floor Room 305	Good	1580 SF	GIS-65 GIS-67 GIS-69	NAD* NAD NAD
M-24	Joint Compound	Third Floor	Good	5000 SF	GIS-70 GIS-71 GIS-72	NAD NAD NAD
M-25	Black Baseboard	Third Floor Stairways	Good	30 LF	GIS-73 GIS-75 GIS-77	NAD* NAD NAD
M-26	Mastic Associated with M-25	Third Floor Stairways	Good	30 LF	GIS-74 GIS-76 GIS-78	NAD* NAD NAD
M-27	Black Tar	Attic	Damaged	10 SF	GIS-79 GIS-80 GIS-81	NAD* NAD NAD
M-28	Black Sheeting	Attic	Damaged	100 SF	GIS-82 GIS-83 GIS-84	NAD* 0.26% Chrysotile 0.26% Chrysotile

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-29	White Caulk	Attic	Damaged	100 SF	GIS-85 GIS-86 GIS-87	NAD* NAD NAD
M-30	Gray Baseboard and Mastic	Third Floor Elevator Area	Good	153 LF	GIS-88 GIS-89 GIS-90	NAD* NAD NAD
M-31	White Floor Tile with Grey Specks 12x12"	2nd Floor Faculty Lounge	Good	696 SF	GIS-91 GIS-93 GIS-95	NAD* NAD NAD
M-32	Mastic Associated with M-31	2nd Floor Faculty Lounge	Good	696 SF	GIS-92 GIS-94 GIS-96	NAD* NAD NAD
M-33A	Blue Baseboard, Lab Split	2nd Floor Faculty Lounge and Room 217	Good	122 LF	GIS-97A GIS-98A GIS-99A	NAD* NAD NAD
M-33B	Mastic, Lab Split	2nd Floor Faculty Lounge and Room 217	Good	122 LF	GIS-97B GIS-98B GIS-99B	NAD* NAD NAD
M-34	Black Baseboard, Lab Split	2nd Floor by Stairwell	Good	250 LF	GIS-100A GIS-101A GIS-102A	NAD* NAD NAD
M-34	Mastic, Lab Split	2nd Floor by Stairwell	Good	250 LF	GIS-100B GIS-101B GIS-102B	NAD* NAD NAD
M-35	Carpet Mastic	Room 219 and 215	Good	918 SF	GIS-103 GIS-104 GIS-105	NAD* NAD NAD
M-36	Drywall Joint Compound	Rooms 219, 217, and 212	Damaged	10000 SF	GIS-106 GIS-107 GIS-108	NAD NAD NAD
M-37	**Black Glue Tar**	**Stair Treads in Stairwells**	**Good**	**2000 SF**	**GIS-109 GIS-110 GIS-111**	**2.6% Chrysotile 2.3% Chrysotile 2.5% Chrysotile**
M-38	Drywall	Rooms 210, 217, and 212	Damaged	1719 SF	GIS-112 GIS-113 GIS-114	NAD NAD NAD
M-39	Pinhole 2x4' Ceiling Tile	217, Hallway Outside 217	Good	5000 SF	GIS-115 GIS-116 GIS-117	NAD NAD NAD
M-40	Dark Blue 12x12" Floor Tile	217 and Outside of Elevator	Good	678 SF	GIS-118 GIS-120 GIS-122	NAD* NAD NAD
M-41	Mastic Associated with M-40	217 and Outside of Elevator	Good	678 SF	GIS-119 GIS-121 GIS-123	NAD* NAD NAD

MONTROSE ENVIRONMENTAL

Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
S-42A	Skin Coat, Lab Split	2nd Floor North	Damaged	10000 SF	GIS-124A GIS-125A GIS-126A	NAD NAD NAD
S-43B	Base Coat, Lab Split	2nd Floor North	Damaged	10000 SF	GIS-124B GIS-125B GIS-126B	NAD NAD NAD
S-42C	Plaster joint compound, Lab Split	2nd Floor North	Damaged	10000 SF	GIS-124C GIS-125C GIS-126C	NAD NAD NAD
M-43	Red 12x12" Floor Tile	Rooms 212, 213, and 208	Good	1857 SF	GIS-127 GIS-129 GIS-131	NAD* NAD NAD
M-44	Mastic Associated with M-43	Rooms 212, 213, and 208	Good	1857 SF	GIS-128 GIS-130 GIS-132	NAD* NAD NAD
M-45	Tan Speckled 12x12" Floor Tile	Rooms 212, 213, and 208	Good	1857 SF	GIS-133 GIS-135 GIS-137	NAD* NAD NAD
M-46	Mastic Associated with M-45	Rooms 212, 213, and 209	Good	1857 SF	GIS-134 GIS-136 GIS-138	NAD* NAD NAD
S-47	Plaster - White	Steps Near Stairwell and 217	Damaged	30000 SF	GIS-139 GIS-141 GIS-143	NAD NAD NAD
S-48	Plaster - Brown	Steps Near Stairwell and 218	Damaged	30000 SF	GIS-140 GIS-142 GIS-144	NAD NAD NAD
M-49	Light Blue 12x12" Floor Tile	Rooms 210, 209/211, and 200	Good	2359 SF	GIS-145 GIS-147 GIS-149	NAD* NAD NAD
M-50	Mastic Associated with M-49	Rooms 210, 209/211, and 200	Good	2359 SF	GIS-146 GIS-148 GIS-150	NAD* NAD NAD
M-51A	Red Baseboard, Lab Split	Rooms 210, 209/211, and 201	Good	2359 LF	GIS-151A GIS-152A GIS-153A	NAD* NAD NAD
M-51B	Mastic, Lab Split	Rooms 210, 209/211, and 202	Good	2359 LF	GIS-151B GIS-152B GIS-153B	NAD* NAD NAD
M-52	Plaster - White	Bathroom, Stairwell across bathroom, end of hall	Damaged	30000 SF	GIS-154 GIS-156 GIS-158	NAD NAD NAD
M-53	Plaster - Brown	Bathroom, Stairwell across bathroom, end of hall	Damaged	30000 SF	GIS-155 GIS-157 GIS-159	NAD NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-54	Black Counters	Rooms 219, 200, and 201	Good	576 SF	GIS-160 GIS-161 GIS-162	NAD NAD NAD
M-55	Lineoleum Black Traction Tread	Hallyway South to Stairs and Stairs	Good	150 SF	GIS-163 GIS-165 GIS-167	NAD* NAD NAD
M-56	Mastic Associated with M-55	Hallyway South to Stairs and Stairs	Good	150 SF	GIS-164 GIS-166 GIS-168	NAD* NAD NAD
M-57	Pinhole and Circular Crater 2x4' White Ceiling Tile	Room 215	Good	222 SF	GIS-169 GIS-170 GIS-171	NAD NAD NAD
M-58	Pinhole and Oblong Crater 2x4' White Ceiling Tile	Room 215	Good	222 SF	GIS-172 GIS-173 GIS-174	NAD NAD NAD
M-59	Black Sink Under Coating	Room 217	Good	75 SF	GIS-175 GIS-176 GIS-177	NAD* NAD NAD
M-60A	Dark Red Baseboard, Lab Split	Room 202 and 200	Damaged	2212 LF	GIS-178A GIS-179A GIS-180A	NAD* NAD NAD
M-60B	Mastic, Lab Split	Room 202 and 200	Damaged	2212 LF	GIS-178B GIS-179B GIS-180B	NAD* NAD NAD
M-61A	Dark Blue Baseboard, Lab Split	Room 201 and South Hallway	Good	1120LF	GIS-181A GIS-182A GIS-183A	NAD* NAD NAD
M-61B	Mastic, Lab Split	Room 201 and South Hallway	Good	1120 LF	GIS-181B GIS-182B GIS-183B	NAD* NAD NAD
M-62	White Floor Tile with Grey Specks 12x12"	Room 201, 200, and 202	Good	2212 SF	GIS-184 GIS-186 GIS-188	NAD* NAD NAD
M-63	Mastic Associated with M-62	Room 201, 200, and 202	Good	2212 SF	GIS-185 GIS-187 GIS-189	NAD* NAD Insufficient Material
M-64	Red 12x12" Floor Tile	Room 201	Good	1120 SF	GIS-190 GIS-192 GIS-194	NAD* NAD NAD
M-65	Mastic Associated with M-64	Room 201	Good	1120 SF	GIS-191 GIS-193 GIS-195	NAD* NAD NAD
M-66	Drywall	Room 200, 201, and 202	Good	5000 SF	GIS-196 GIS-197 GIS-198	NAD NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-67	Drywall Joint Compound	Room 200, 201, and 202	Good	4500 SF	GIS-199 GIS-200 GIS-201	NAD NAD NAD
M-68	Light Blue 12x12" Floor Tile	Room 200	Good	1092 SF	GIS-202 GIS-204 GIS-206	NAD* NAD NAD
M-69	Floor Leveling Associated with M-68	Room 200	Good	1092 SF	GIS-203 GIS-205 GIS-207	NAD* NAD NAD
M-70	Hood Backing	Room 200 Prep Room	Good	50 SF	GIS-208 GIS-209 GIS-210	NAD* NAD NAD
M-71A	Dark Blue Stair Tread, Lab Split	South Stairs	Good	6500 SF	GIS-211A GIS-212A GIS-213A	NAD* NAD NAD
M-71B	Mastic, Lab Split	South Stairs	Good	6500 SF	GIS-211B GIS-212B GIS-213B	NAD* NAD NAD
M-72	Dark Blue 12x12" Floor Tile	1st Level by Room 114	Damaged	451 SF	GIS-214 GIS-216 GIS-218	NAD* NAD NAD
M-73	Mastic Associated with M-72	1st Level by Room 114	Damaged	451 SF	GIS-215 GIS-217 GIS-219	NAD* NAD NAD
M-74	White Floor Tile with Grey Specks 12x12"	1st Level by Room 114	Damaged	451 SF	GIS-220 GIS-222 GIS-224	NAD* NAD NAD
M-75	Mastic Associated with M-74	1st Level by Room 114	Damaged	451 SF	GIS-221 GIS-223 GIS-225	NAD* NAD NAD
M-76A	Red Baseboard, Lab Split	Room 114	Damaged	200 LF	GIS-226A GIS-227A GIS-228A	NAD* NAD NAD
M-76B	Mastic, Lab Split	Room 114	Damaged	200 LF	GIS-226B GIS-227B GIS-228B	NAD* NAD NAD
M-77A	Blue Baseboard, Lab Split	Hallway Outside Library, Library	Damaged	4000 LF	GIS-229A GIS-230A GIS-231A	NAD* NAD NAD
M-77B	Mastic, Lab Split	Hallway Outside Library, Library	Damaged	4000 LF	GIS-229B GIS-230B GIS-231B	NAD* NAD NAD
M-78	Carpet Mastic	Library and Room 114	Good	5500 SF	GIS-232 GIS-233 GIS-234	NAD* NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
S-79	White Plaster	Library, Hallway outside Library, Closet across 114	Damaged	35000 SF	GIS-235 GIS-237 GIS-239	NAD NAD NAD
S-80	Brown Plaster	Library, Hallway outside Library, Closet across 114	Damaged	35000 SF	GIS-236 GIS-238 GIS-240	NAD NAD NAD
M-81	Drywall	Inside storage near 116, and Rooms 116 and 114	Good	30000 SF	GIS-241 GIS-242 GIS-243	NAD NAD NAD
M-82	White Pinhole 2'x4' Ceiling Tile	Hallway Outside Library	Good	15000 SF	GIS-244 GIS-245 GIS-246	NAD NAD NAD
M-83	Pinhole with Small Circular Crater White 2'x4' Ceiling Tile	Inside storage near 116, hall outside storage, outside 114	Good	8000 SF	GIS-247 GIS-248 GIS-249	NAD NAD NAD
M-84	Spray-On Insulation	Inside both maintenance closets in library hallway	Good	32000 SF	GIS-250 GIS-253 GIS-256 GIS-251 GIS-254 GIS-252 GIS-255	NAD for all
M-85	Black Window Ledge	Corridor before gym north and south	Damaged	20 LF	GIS-257 GIS-258 GIS-259	NAD NAD NAD
M-86	Tan Color Speckled 12x12" Floor Tile	Office 110 in locker room and office 111 in girls locker room	Damaged	300 SF	GIS-260 GIS-262 GIS-264	NAD* NAD NAD
M-87	Mastic Associated with M-86	Office 110 in locker room and office 111 in girls locker room	Damaged	300 SF	GIS-261 GIS-263 GIS-265	NAD* NAD NAD
M-88	Joint Compound	Room 114, across 114 storage near 116	Damaged	10000 SF	GIS-266 GIS-267 GIS-268	NAD NAD NAD
S-89	White Plaster	North stairwell area	Damaged	10000 SF	GIS-269 GIS-271 GIS-273	NAD NAD NAD
S-90	Brown Plaster	North stairwell area	Damaged	10000 SF	GIS-270 GIS-272 GIS-274	NAD NAD NAD
M-91	Red 12x12" Floor Tile	Room 109	Good	614 SF	GIS-275 GIS-277 GIS-279	NAD* NAD NAD
M-92	Mastic Associated with M-91	Room 109	Good	614 SF	GIS-276 GIS-278 GIS-280	NAD* NAD NAD
M-93A	Red Baseboard, Lab Split	Room 109	Good	200 LF	GIS-281A GIS-282A GIS-283A	NAD* NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-93B	Mastic, Lab Split	Room 109	Good	200 LF	GIS-281B GIS-282B GIS-283B	NAD* NAD NAD
M-94	Dark Green with Colored Specks 12"x12" Floor Tile	Room 107	Good	641 SF	GIS-284 GIS-286 GIS-288	NAD* NAD NAD
M-95	Mastic Associated with M-94	Room 107	Good	641 SF	GIS-285 GIS-287 GIS-289	NAD* NAD NAD
M-96A	Green Baseboard, Lab Split	Room 107	Good	200 LF	GIS-290A GIS-291A GIS-292A	NAD* NAD NAD
M-96B	Mastic, Lab Split	Room 107	Good	200 LF	GIS-290B GIS-291B GIS-292B	NAD* NAD NAD
M-97A	Black Baseboard, Lab Split	Near Stairways	Good	100 LF	GIS-293A GIS-294A GIS-295A	NAD* NAD NAD
M-97B	Mastic, Lab Split	Near Stairways	Good	100 LF	GIS-293B GIS-294B GIS-295B	NAD* NAD NAD
M-98	Light Green with Colored Specks 12"x12" Floor Tile	Room 110-1, Principals Office, and Staffing Dining	Good	1200 SF	GIS-296 GIS-298 GIS-300	NAD* NAD NAD
M-99	Mastic associated with M-98	Room 110-1, Principals Office, and Staffing Dining	Good	1200 SF	GIS-297 GIS-299 GIS-301	NAD* NAD NAD
M-100A	Burgundy Baseboard, Lab Split	Main Office	Good	200 SF	GIS-302A GIS-303A GIS-304A	NAD* NAD NAD
M-100B	Mastic, Lab Split	Main Office	Good	200 SF	GIS-302B GIS-303B GIS-304B	NAD* NAD NAD
M-101	Tan with Colored Specks 12"x12" Floor Tile	Rooms 109, 107, and 105	Good	2200 SF	GIS-305 GIS-307 GIS-309	NAD* NAD NAD
M-102	Mastic associated with M-101	Rooms 109, 107, and 105	Good	2200 SF	GIS-306 GIS-308 GIS-310	Insufficient Material NAD* Insufficient Material
M-103	Yellow Carpet Mastic	Main Office	Good	917 SF	GIS-311 GIS-312 GIS-313	NAD* NAD NAD
M-104	Pinhole 2'x4' White Ceiling Tile	North stairwell, South stairwell, Room 107	Good	35000 SF	GIS-314 GIS-315 GIS-316	NAD NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-105	White with Specks 12"x12" Floor Tile	Elevator Area, Level 1	Good	153 SF	GIS-317 GIS-319 GIS-321	NAD* NAD NAD
M-106	Mastic Associated with M-105	Elevator Area, Level 1	Good	153 SF	GIS-318 GIS-320 GIS-322	NAD* NAD NAD
M-107	Dark Blue with Specks 12"x12" Floor Tile	Elevator Area, Level 1	Good	153 SF	GIS-323 GIS-325 GIS-327	NAD* NAD NAD
M-108	Mastic associated with M-107	Elevator Area, Level 1	Good	153 SF	GIS-324 GIS-326 GIS-328	NAD* NAD NAD
S-109	White Plaster	South stairwell, Room 105, and Room 109	Damaged	40000 SF	GIS-329 GIS-331 GIS-333	NAD NAD NAD
S-110	Brown Plaster	South stairwell, Room 105, and Room 109	Damaged	40000 SF	GIS-330 GIS-332 GIS-334	NAD NAD NAD
M-111	Drywall	Room 105, Main Office, and Room 109	Good	25000 SF	GIS-335 GIS-336 GIS-337	NAD NAD NAD
M-112	12"x12" Pink Floor Tile	Nurse Room 106	Good	768 SF	GIS-338 GIS-340 GIS-342	NAD* NAD NAD
M-113	Mastic associated with M-112	Nurse Room 106	Good	768 SF	GIS-339 GIS-341 GIS-343	NAD* NAD NAD
M-114	Black Sink Under Coating	Nurse Room 106	Good	25 SF	GIS-344 GIS-345 GIS-346	NAD* NAD NAD
M-115	Light Green with White Specks 12"x12" Floor Tile	Nurse Room 106	Good	768 SF	GIS-347 GIS-349 GIS-351	NAD* NAD NAD
M-116	Mastic Associated with M-115	Nurse Room 106	Good	768 SF	GIS-348 GIS-350 GIS-352	NAD* NAD NAD
M-117	White 12"x12" Floor with Green Specks	Nurse Room 106	Good	768 SF	GIS-353 GIS-355 GIS-357	NAD* NAD NAD
M-118	Mastic Associated with M-117	Nurse Room 106	Good	768 SF	GIS-354 GIS-356 GIS-358	NAD* NAD NAD
M-119	Joint Compound	South Staircase, Room 105, and near elevator	Damaged	12000 SF	GIS-359 GIS-360 GIS-361	NAD NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-120	Dark Yellow Carpet Mastic	Room 103	Good	246 SF	GIS-362 GIS-363 GIS-364	NAD* NAD NAD
S-121	White Spray Insulation	Room 103 Ceiling	Good	3000 SF	GIS-365 GIS-368 GIS-371 GIS-366 GIS-369 GIS-367 GIS-370	NAD for all
M-122	Beige 12"x12" Speckled Floor Tile	Cafeteria	Good	3388 SF	GIS-372 GIS-374 GIS-376	NAD* NAD NAD
M-123	Mastic Associated with M-122	Cafeteria	Good	3388 SF	GIS-373 GIS-375 GIS-377	NAD* NAD NAD
M-124	Red 12x12" Floor Tile	Cafeteria	Good	3388 SF	GIS-378 GIS-380 GIS-382	NAD* NAD NAD
M-125	Mastic Associated with M-124	Cafeteria	Good	3388 SF	GIS-379 GIS-381 GIS-383	NAD* NAD NAD
M-126	Green 12"x12" Floor Tile	Cafeteria	Good	3388 SF	GIS-384 GIS-386 GIS-388	NAD* NAD NAD
M-127	Mastic Associated with M-126	Cafeteria	Good	3388 SF	GIS-385 GIS-387 GIS-389	NAD* NAD NAD
M-128	Blue 12"x12" Floor Tile	Cafeteria	Good	3388 SF	GIS-390 GIS-392 GIS-394	NAD* NAD NAD
M-129	Mastic Associated with M-128	Cafeteria	Good	3388 SF	GIS-391 GIS-393 GIS-395	NAD* NAD NAD
M-130A	Blue Baseboard, Lab Split	Cafeteria	Good	3388 SF	GIS-396A GIS-397A GIS-398A	NAD* NAD NAD
M-130B	Mastic, Lab Split	Cafeteria	Good	3388 SF	GIS-396B GIS-397B GIS-398B	NAD* NAD NAD
M-131A	Blue Baseboard, Lab Split	Cafeteria Hallway	Good	700 LF	GIS-399A GIS-400A GIS-401A	NAD* NAD NAD
M-131B	Mastic, Lab Split	Cafeteria Hallway	Good	700 LF	GIS-399B GIS-400B GIS-401B	NAD* NAD NAD
M-132	Teal 12"x12" Linoleum Floor Tile	Back Entrance Ramp	Good	251 SF	GIS-402 GIS-404 GIS-406	NAD* NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-133	Mastic Associated with M-132	Back Entrance Ramp	Good	251 SF	GIS-403 GIS-405 GIS-407	NAD NAD* NAD
M-134	White with Specks 12"x12" Floor Tile	Back Entrance	Good	95 SF	GIS-408 GIS-410 GIS-412	NAD* NAD NAD
M-135	Mastic Associated with M-134	Back Entrance	Good	95 SF	GIS-409 GIS-411 GIS-413	NAD* NAD NAD
M-136	White 2'x2' Pinhole Ceiling Tile	Cafeteria Hallway	Good	5000 SF	GIS-414 GIS-415 GIS-416	NAD NAD NAD
M-137	White 2'x4' Pinhole Ceiling Tile	Cafeteria Hallway	Good	5000 SF	GIS-417 GIS-418 GIS-419	NAD NAD NAD
M-138	Tan Carpet Mastic	Room 100	Good	1272 SF	GIS-420 GIS-421 GIS-422	NAD* NAD NAD
M-139	Gray Boiler Insulation 1	Basement by Street	Good	100 SF	GIS-423 GIS-424 GIS-425	NAD NAD NAD
M-140	Gray Boiler Insulation 2	Basement by Street	Good	100 SF	GIS-426 GIS-427 GIS-428	NAD NAD NAD
M-141	Red Boiler Caulk	Basement by Street	Good	20 LF	GIS-429 GIS-430 GIS-431	NAD* NAD NAD
M-142	Gray Spray-On Insulation	Basement by Back-Street	Good	241 SF	GIS-432 GIS-435 GIS-438 GIS-433 GIS-436 GIS-434 GIS-437	NAD for all
M-143	**Brown 9"x9" Floor Tile**	**Basement first room on right**	**Damaged**	**494 SF**	**GIS-439 GIS-441 GIS-443**	**3.0% Chrysotile 3.0% Chrysotile 4.4% Chrysotile**
M-144	**Mastic Associated with M143**	**Basement first room on right**	**Damaged**	**494 SF**	**GIS-440 GIS-442 GIS-444**	**0.41% Chrysotile* 0.40% Chrysotile 0.37% Chrysotile**
M-145	Fire Caulk	Emergency Fire Exit	Good	50 LF	GIS-445 GIS-446	NAD* NAD
M-146	Debris from Crawlspace	Crawl Space with Asbestos Hazard Sign	Damaged	100 SF	GIS-448 GIS-449 GIS-450	NAD NAD NAD
P-1	**Pipe Insulation/Elbows**	**Possibly Behind Fixed Walls**	**Unknown**	**Unknown**	**Not Sampled**	**Presumed ACM**

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Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
P-2	**Wire Insulation**	**Possibly Behind Fixed Walls**	**Unknown**	**Unknown**	**Not Sampled**	**Presumed ACM**
Roofing Systems						
M-01	Black Mats	Roof 1 Lower Right	Damaged	8 SF ea. (~70 total)	GISR-1 GISR-2 GISR-3	NAD* NAD NAD
M-02	Silver Roof Liner	Roof 1 Lower Right	Good	195 LF	GISR-4 GISR-5 GISR-6	NAD* NAD NAD
M-03A	Roof Core - Roofing	Roof 1 Lower Right	Good	2012 SF	GISR-7A	NAD*
M-03B	Roof Core -Tar, Lab Split	Roof 1 Lower Right	Good	2012 SF	GISR-7B	NAD*
M-03C	Roof Core -Tar Felt	Roof 1 Lower Right	Good	2012 SF	GISR-7C	NAD*
M-03D	Roof Core -Tar Paper	Roof 1 Lower Right	Good	2012 SF	GISR-7D	NAD*
M-03E	Roof Core - Insulation	Roof 1 Lower Right	Good	2012 SF	GISR-7E	NAD
M-03F	Roof Core -Foam	Roof 1 Lower Right	Good	2012 SF	GISR-7F	NAD
M-04	HVAC Skirt	Roof 1 Lower Right	Good	41 LF ea. (~8 total)	GISR-8 GISR-9 GISR-10	NAD* NAD NAD
M-05	Tar	Roof 1 Middle Near Drain	Damaged	2 SF ea. (~10 total)	GISR-11 GISR-12 GISR-13	NAD* NAD NAD
M-03F	Roof Core - Roofing	Roof 1 Middle	Good	8091 SF	GISR-14A	NAD
M-03G	Roof Core -Tar	Roof 1 Middle	Good	8091 SF	GISR-14B	NAD
M-03H	Roof Core -Tar Felt	Roof 1 Middle	Good	8091 SF	GISR-14C	NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-03I	Roof Core -Tar Paper	Roof 1 Middle	Good	8091 SF	GISR-14D	NAD
M-03J	Roof Core - Membrane	Roof 1 Middle	Good	8091 SF	GISR-14E	NAD*
M-03K	Roof Core - Insulation	Roof 1 Middle	Good	8091 SF	GISR-14F	NAD
M-03L	Roof Core -Foam	Roof 1 Middle	Good	8091 SF	GISR-14G	NAD
M-06	Metal Coating on Pipe	Roof 1 Middle	Good	1 LF ea. (~ 10 total)	GISR-15 GISR-16 GISR-17	NAD* NAD NAD
M-07	**Tar**	**Roof 1 Middle on Ledge**	**Good**	**70 LF**	**GISR-18 GISR-19 GISR-20**	**3.0% Chrysotile NAD NAD**
M-08	**Copper Flashing Mastic**	**Roof 1 Upper Left**	**Damaged**	**195 LF**	**GISR-21 GISR-22 GISR-23**	**NAD* 5.3% Chrysotile NAD**
M-09	Tar	Roof 1 Upper Left	Good	195 LF	GISR-24A	0.46% Chrysotile*
M-09A	**Sealant**	**Roof 1 Upper Left**	**Good**	**195 LF**	**GISR-24B**	**8.2% Chrysotile**
M-09B	**Tar**	**Roof 1 Upper Left**	**Good**	**195 LF**	**GISR-25**	**2.3% Chrysotile**
M-09C	Tar	Roof 1 Upper Left	Good	195 LF	GISR-26A	NAD
M-09D	Sealant	Roof 1 Upper Left	Good	195 LF	GISR-26B	NAD
M-0M	Roof Core - Roofing	Roof 1 Lower Left	Good	590 SF	GISR-27A	NAD
M-03N	Roof Core -Tar	Roof 1 Lower Left	Good	590 SF	GISR-27B	NAD
M-03O	Roof Core -Tar Felt	Roof 1 Lower Left	Good	590 SF	GISR-27C	NAD

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Table 1
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Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-03P	Roof Core -Tar Paper	Roof 1 Lower Left	Good	590 SF	GISR-27D	NAD
M-03Q	Roof Core - Insulation	Roof 1 Lower Left	Good	590 SF	GISR-27E	NAD
M-03R	Roof Core -Foam	Roof 1 Lower Left	Good	595 SF	GISR-27F	NAD
M-10	Black Caulk	Roof 1 Lower Left	Damaged	109 LF	GISR-28 GISR-29 GISR-30	NAD* NAD NAD
M-11	**White Caulk**	**Roof 1 Lower Left**	**Damaged**	109 LF	**GISR-31** **GISR-32** **GISR-33**	**2.8% Chrysotile** **NAD** **NAD**
M-12	White Caulk	Roof 2 Lower Right	Good	109 LF	GISR-34 GISR-35 GISR-36	NAD* NAD NAD
M-13	**Black Caulk**	**Roof 2 Lower Right**	**Good**	109 LF	**GISR-37** **GISR-38** **GISR-39**	**6.9% Chrysotile** **NAD** **NAD**
M-14A	Roof Core - Roofing	Roof 2 Lower Right	Good	1766 SF	GISR-40A	NAD
M-14B	Roof Core -Tar	Roof 2 Lower Right	Good	1766 SF	GISR-40B	0.21% Chrysotile*
M-14C	Roof Core -Tar Felt	Roof 2 Lower Right	Good	1766 SF	GISR-40C	NAD
M-14D	Roof Core - Insulation	Roof 2 Lower Right	Good	1766 SF	GISR-40D	NAD
M-15	**Black Mastic**	**Roof 2 Upper Right**	**Good**	**331 LF**	**GISR-41** **GISR-42** **GISR-43**	**6.7% Chrysotile*** **3.5% Chrysotile** **NAD**
M-14E	Roof Core - Roofing	Roof 2 Upper Right	Good	2034 SF	GISR-44A	0.17% Chrysotile*
M-14F	**Roof Core - Tar Felt**	**Roof 2 Upper Right**	**Good**	2034 SF	**GISR-44B**	**2.4% Chrysotile***
M-14G	**Roof Core - Tar Paper**	**Roof 2 Upper Right**	**Good**	2034 SF	**GISR-44C**	**1.1 % Chrysotile**

MONTROSE ENVIRONMENTAL

Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-14H	Roof Core -Tar	Roof 2 Upper Right	Good	2034 SF	GISR-44D	<0.1% Chrysotile*
M-14I	Roof Core - Insulation	Roof 2 Upper Right	Good	2034 SF	GISR-44E	NAD
M-16	**Black Tar Sealant**	**Roof 2 Upper Left**	**Good**	**98 LF**	**GISR-45 GISR-46 GISR-47**	**6.1 % Chrysotile* 2.7 % Chrysotile NAD**
M-14J	Roof Core - Roofing	Roof 2 Lower Right	Good	1766 SF	GISR-48A	NAD
M-14K	Roof Core -Tar Felt	Roof 2 Lower Right	Good	1766 SF	GISR-48B	NAD
M-14L	Roof Core -Tar	Roof 2 Lower Right	Good	1766 SF	GISR-48C	NAD
M-14M	Roof Core - Insulation	Roof 2 Lower Right	Good	1766 SF	GISR-48D	NAD
M-17A	Roof Core - Roofing	Roof 3	Good	286 SF	GISR-49A	<0.19% Chrysotile*
M-17B	Roof Core -Tar Felt	Roof 3	Good	286 SF	GISR-49B	NAD*
M-17C	Roof Core -Tar	Roof 3	Good	286 SF	GISR-49C	NAD*
M-17E	Roof Core - Roofing	Roof 3	Good	286 SF	GISR-50A	NAD
M-17F	Roof Core -Tar Felt	Roof 3	Good	286 SF	GISR-50B	NAD
M-17G	Roof Core -Tar Paper	Roof 3	Good	286 SF	GISR-50C	<0.1% Chrysotile
M-17H	Roof Core -Tar	Roof 3	Good	286 SF	GISR-50D	<0.25% Chrysotile
M-17I	Roof Core - Insulation	Roof 3	Good	286 SF	GISR-50E	NAD

Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-17J	Roof Core -Foam	Roof 3	Good	286 SF	GISR-50F	NAD
M-14N	Roof Core - Roofing	Roof 2 Upper Left	Good	343 SF	GISR-51A	NAD
M-14O	Roof Core -Tar	Roof 2 Upper Left	Good	343 SF	GISR-51B	<0.25% Chrysotile
M-14P	Roof Core - Insulation	Roof 2 Upper Left	Good	343 SF	GISR-51C	NAD

Key

NAD= No asbestos detected

NAD*= No asbestos detected, confirmed via TEM

SF= Square feet

*= Determined via TEM

LF= Linear feet

= Confirmed ACM

TABLE 2

XRF Testing Results

MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/28/2022	1	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.01	0.1
7/28/2022	2	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.07	0.1
7/28/2022	3	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.04	0.1
7/28/2022	4	3rd Fl Hallway	Wall	Plaster	Beige	Intact	Negative	0.11	0.06
7/28/2022	5	3rd Fl Hallway	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
7/28/2022	6	3rd Fl Hallway	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
7/28/2022	7	3rd Fl Hallway	Wall	Plaster	Beige	Intact	Negative	0.1	0.03
7/28/2022	8	3rd Fl Hallway	Floor	Painted Tiles	Gray	Intact	Negative	<LOD	0.01
7/28/2022	9	3rd Fl Hallway	Baseboard	Concrete	Gray	Intact	Negative	0.14	0.07
7/28/2022	10	3rd Fl Hallway	Window Frame	Wood	Beige	Intact	Inconclusive	0.99	0.1
7/28/2022	11	3rd Fl Hallway	Window Frame	Wood	Beige	Intact	Negative	0.78	0.1
7/28/2022	12	3rd Fl Hallway	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.01
7/28/2022	13	3rd Fl Hallway	Window Sill	Wood	Beige	Intact	Inconclusive	0.95	0.15
7/28/2022	**14**	**3rd Fl Hallway**	**Window Sill**	**Wood**	**Beige**	**Fair**	**Positive**	**1.55**	**0.28**
7/28/2022	15	3rd Fl Hallway	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.01
7/28/2022	16	3rd Fl Hallway	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.01
7/28/2022	17	310	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
7/28/2022	18	310	Wall	Concrete	Beige	Intact	Negative	0.02	0.01
7/28/2022	19	310	Wall	Concrete	Beige	Intact	Negative	0.1	0.03
7/28/2022	20	310	Wall	Concrete	Beige	Intact	Negative	0.04	0.01
7/28/2022	21	310	Shelving	Wood	Beige	Intact	Negative	0.09	0.04
7/28/2022	22	310	Chalkboard	Wood	Beige	Intact	Negative	0.06	0.02
7/28/2022	23	310	Chalkboard	Wood	Beige	Intact	Negative	0.04	0.01
7/28/2022	24	310	Baseboard	Wood	Beige	Intact	Negative	0.02	0.01
7/28/2022	25	Stairwell North	Wall	Plaster	Yellow	Intact	Negative	0.03	0.01
7/28/2022	26	Stairwell North	Wall	Plaster	Yellow	Intact	Negative	0.05	0.01
7/28/2022	27	Stairwell North	Wall	Plaster	Yellow	Intact	Negative	<LOD	0.01
7/28/2022	**28**	**Stairwell North**	**Wall**	**Plaster**	**Yellow**	**Fair**	**Positive**	**1.65**	**0.23**

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MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/28/2022	29	Stairwell North	Wall	Plaster	Yellow	Intact	Negative	0.03	0.01
7/28/2022	30	Stairwell North	Newel Post	Metal	Black	Intact	Inconclusive	0.93	0.1
7/28/2022	**31**	**Stairwell North**	**Newel Post**	**Metal**	**Black**	**Fair**	**Positive**	**1.16**	**0.1**
7/28/2022	32	Stairwell North	Railing	Metal	Black	Intact	Negative	<LOD	0.01
7/28/2022	33	Stairwell North	Railing	Metal	Black	Intact	Negative	0.33	0.1
7/28/2022	34	Stairwell North	Stringer	Metal	Black	Intact	Inconclusive	1.07	0.1
7/28/2022	**35**	**Stairwell North**	**Stringer**	**Metal**	**Black**	**Fair**	**Positive**	**1.64**	**0.18**
7/28/2022	36	Stairwell North	Riser	Metal	Gray	Intact	Inconclusive	0.9	0.1
7/28/2022	37	Stairwell North	Riser	Metal	Gray	Intact	Inconclusive	0.86	0.1
7/28/2022	38	Stairwell North	Riser	Metal	Gray	Intact	Negative	0.7	0.1
7/28/2022	39	Stairwell North	Tread	Metal	Gray	Intact	Negative	0.26	0.09
7/28/2022	40	Stairwell North	Tread	Metal	Black	Intact	Negative	0.11	0.04
7/28/2022	41	Stairwell North Top Str	Paneling	Wood	Beige	Intact	Negative	0.26	0.04
7/28/2022	42	Stairwell North Top Str	Window Frame	Wood	Beige	Intact	Negative	0.24	0.04
7/28/2022	43	Stairwell North Top Str	Window Sash	Wood	Beige	Intact	Negative	0.33	0.1
7/28/2022	44	Stairwell North Top Str	Window Sill	Wood	Beige	Intact	Negative	0.23	0.05
7/28/2022	45	Stairwell North Top Storage	Wall	Plaster	Beige	Intact	Negative	0.32	0.1
7/28/2022	46	307	Wall	Plaster	Beige	Intact	Negative	0.58	0.1
7/28/2022	47	307	Wall	Plaster	Beige	Intact	Negative	0.25	0.04
7/28/2022	48	307	Wall	Plaster	Beige	Intact	Negative	0.52	0.1
7/28/2022	49	307	Wall	Plaster	Beige	Intact	Negative	0.55	0.1
7/28/2022	50	307	Door Frame	Metal	Blue	Intact	Negative	0.17	0.01
7/28/2022	51	307	Door Jamb	Metal	Blue	Intact	Negative	0.14	0.01
7/28/2022	52	Calibration	Red Film	Film	Red		Positive	1.64	0.1
7/28/2022	53	Calibration	Red Film	Film	Red		Positive	1.69	0.1
7/28/2022	54	Calibration	Red Film	Film	Red		Positive	2.05	0.1
7/28/2022	55	Standardization					PASS		
7/28/2022	56						NULL		

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MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/28/2022	57	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.08	0.1
7/28/2022	58	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.04	0.1
7/28/2022	59	Calibration	Red Film	Film	Red	Intact	Positive	1.19	0.1
7/28/2022	60	305	Wall	Plaster	Beige	Intact	Negative	0.03	0.02
7/28/2022	61	305	Wall	Plaster	Beige	Intact	Negative	<LOD	0.03
7/28/2022	62	305	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
7/28/2022	63	305	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
7/28/2022	64	305	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/28/2022	65	305	Window Frame	Wood	Beige	Intact	Negative	0.43	0.1
7/28/2022	66	305	Window Sill	Wood	Beige	Intact	Inconclusive	0.94	0.1
7/28/2022	67	305	Window Sill	Wood	Beige	Intact	Negative	0.59	0.1
7/28/2022	68	305	Window Trim	Wood	Beige	Intact	Negative	0.09	0.02
7/28/2022	69	306	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.02
7/28/2022	70	306	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.01
7/28/2022	71	306	Window Frame	Wood	Beige	Intact	Negative	0.31	0.1
7/28/2022	72	306	Window Sill	Wood	Beige	Intact	Negative	0.34	0.1
7/28/2022	73	306	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.02
7/28/2022	74	306	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.03
7/28/2022	75	306	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.04
7/28/2022	76	306	Window Sill	Wood	Beige		Negative	0.04	0.02
7/28/2022	77	Calibration	Red Film	Film	Red		Inconclusive	1.05	0.1
7/28/2022	78	Calibration	Red Film	Film	Red		Inconclusive	1.15	0.1
7/28/2022	79	Calibration	Red Film	Film	Red		Inconclusive	1.05	0.1
7/28/2022	80	Standardization					PASS		
7/28/2022	81	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.14	0.1
7/28/2022	82	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.07	0.1
7/28/2022	83	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.06	0.1
7/28/2022	84	306	Door Frame	Wood	Aqua	Intact	Negative	<LOD	0.02

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MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/28/2022	85	306	Door Cover	Drywall	Beige	Intact	Negative	<LOD	0.01
7/28/2022	86	3rd Fl Elevator Hall	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.04
7/28/2022	87	3rd Fl Elevator Hall	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.01
7/28/2022	88	3rd Fl Elevator Hall	Door	Metal	Blue	Intact	Negative	<LOD	0.01
7/28/2022	89	3rd Fl Elevator Hall	Wall	Drywall	White	Intact	Negative	<LOD	0.02
7/28/2022	90	3rd Fl Elevator Hall	Wall	Drywall	White	Intact	Negative	<LOD	0.01
7/28/2022	91	3rd Fl Elevator Hall	Wall	Concrete	White	Intact	Negative	<LOD	0.01
7/28/2022	92	3rd Fl Elevator Hall	Wall	Drywall	White	Intact	Negative	<LOD	0.05
7/28/2022	93	303	Shelving	Wood	White	Intact	Negative	<LOD	0.03
7/28/2022	94	303	Shelving	Wood	White	Intact	Negative	0.02	0.01
7/28/2022	95	303	Shelving	Wood	White	Intact	Negative	0.02	0.01
7/28/2022	96	303	Shelving	Wood	White	Intact	Negative	<LOD	0.03
7/28/2022	97	301	Window Frame	Wood	Beige	Fair	Inconclusive	1.07	0.1
7/28/2022	98	301	Window Frame	Wood	Beige	Fair	Inconclusive	1.01	0.1
7/28/2022	**99**	**301**	**Window Frame**	**Wood**	**Beige**	**Fair**	**Positive**	**1.5**	**0.17**
7/28/2022	**100**	**301**	**Window Sill**	**Wood**	**Beige**	**Fair**	**Positive**	**1.5**	**0.18**
7/28/2022	101	3rd Fl Hallway	Window Sill	Wood	Beige	Intact	Inconclusive	1.23	0.16
7/28/2022	102	3rd Fl Hallway	Window Sill	Wood	Beige	Intact	Inconclusive	1.04	0.15
7/28/2022	103	3rd Fl Hallway	Window Sill	Wood	Beige	Intact	Negative	0.39	0.1
7/28/2022	104	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.1	0.1
7/28/2022	105	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.15	0.1
7/29/2022	106	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.06	0.1
7/29/2022	107	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.11	0.1
7/29/2022	108	Standardization					PASS		
7/29/2022	109	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.03	0.1
7/29/2022	110	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.14	0.1
7/29/2022	111	Calibration	Red Film	Film	Red	Intact	Positive	1.2	0.1
7/29/2022	112	2nd Fl Hallway North	Wall	Plaster	Beige	Intact	Negative	0.02	0.01

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MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/29/2022	113	2nd Fl Hallway North	Wall	Plaster	Beige	Intact	Negative	<LOD	0.02
7/29/2022	114	2nd Fl Hallway North	Wall	Plaster	Beige	Intact	Negative	<LOD	0.03
7/29/2022	115	2nd Fl Hallway North	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
7/29/2022	**116**	**2nd Fl Hallway North**	**Baseboard**	**Wood**	**White**	**Fair**	**Positive**	**8.49**	**1.01**
7/29/2022	**117**	**2nd Fl Hallway North**	**Baluster**	**Wood**	**Beige**	**Fair**	**Positive**	**4.46**	**0.73**
7/29/2022	**118**	**2nd Fl Hallway North**	**Stringer**	**Wood**	**Beige**	**Fair**	**Positive**	**4.26**	**0.56**
7/29/2022	**119**	**2nd Fl Hallway North**	**Window Frame**	**Wood**	**Beige**	**Fair**	**Positive**	**6.22**	**1.58**
7/29/2022	**120**	**2nd Fl Hallway North**	**Window Sill**	**Wood**	**Beige**	**Fair**	**Positive**	**2.68**	**0.48**
7/29/2022	121	2nd Fl Hallway North	Wall	Plaster	Beige	Intact	Negative	<LOD	0.03
7/29/2022	**122**	**2nd Fl Hallway North**	**Door Frame**	**Wood**	**Beige**	**Fair**	**Positive**	**6.76**	**1**
7/29/2022	**123**	**2nd Fl Hallway North**	**Door**	**Wood**	**Beige**	**Fair**	**Positive**	**6.3**	**1.91**
7/29/2022	124	2nd Fl Hallway North	Door	Wood	White	Intact	Negative	<LOD	0.02
7/29/2022	125	2nd Fl Hallway North	Door Frame	Wood	White	Intact	Negative	<LOD	0.02
7/29/2022	126	217	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	127	217	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	128	217	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	129	217	Wall	Plaster	Beige	Intact	Negative	0.22	0.05
7/29/2022	130	217	Trim	Wood	Beige	Intact	Negative	0.07	0.04
7/29/2022	131	217	Trim	Wood	Beige	Intact	Negative	0.11	0.05
7/29/2022	132	217	Trim	Wood	Beige	Intact	Negative	0.03	0.01
7/29/2022	133	219	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	134	219	Wall	Plaster	Beige	Intact	Negative	0.08	0.02
7/29/2022	135	219	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	136	219	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	137	219	Trim	Drywall	Beige	Intact	Negative	0.11	0.06
7/29/2022	138	219	Trim	Drywall	Beige	Intact	Negative	0.15	0.07
7/29/2022	139	219	Trim	Drywall	Beige	Intact	Negative	0.02	0.01
7/29/2022	140	219	Trim	Drywall	Beige	Intact	Negative	0.07	0.04

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MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/29/2022	141	219	Trim	Drywall	Beige	Intact	Negative	0.04	0.02
7/29/2022	142	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.04	0.1
7/29/2022	143	215	Wall	Plaster	Beige	Intact	Negative	0.1	0.05
7/29/2022	144	215	Wall	Plaster	Beige	Intact	Negative	0.07	0.03
7/29/2022	145	215	Wall	Plaster	Beige	Intact	Negative	0.04	0.01
7/29/2022	146	215	Wall	Plaster	Beige	Intact	Negative	0.17	0.07
7/29/2022	147	215	Baseboard	Wood	Aqua	Intact	Negative	0.18	0.07
7/29/2022	148	215	Baseboard	Wood	Aqua	Intact	Negative	0.13	0.05
7/29/2022	149	215	Cabinet	Wood	Aqua	Intact	Negative	0.17	0.05
7/29/2022	150	215	Cabinet	Wood	Aqua	Intact	Negative	0.23	0.09
7/29/2022	151	215	Trim	Wood	Aqua	Intact	Negative	0.33	0.1
7/29/2022	152	215	Door Frame	Wood	Aqua	Intact	Negative	0.18	0.06
7/29/2022	153	215	Door Frame	Wood	Beige	Intact	Negative	0.36	0.1
7/29/2022	154	215	Door Jamb	Wood	Beige	Intact	Negative	0.39	0.1
7/29/2022	155	215	Door	Wood	Beige	Intact	Negative	0.39	0.1
7/29/2022	156	215	Door	Wood	Aqua	Intact	Negative	0.38	0.1
7/29/2022	157	215	Door	Wood	Light Blue	Intact	Negative	0.6	0.1
7/29/2022	158	Calibration	Red Film	Film	Red	Intact	Positive	1.54	0.1
7/29/2022	159	Calibration	Red Film	Film	White	Intact	Negative	0.72	0.1
7/29/2022	160	Calibration	Red Film	Film	White	Intact	Inconclusive	0.9	0.1
7/29/2022	161	Calibration	White Film	Film	White	Intact	Negative	<LOD	0.01
7/29/2022	162	Calibration	Red Film	Film	Red	Intact	Positive	1.15	0.1
7/29/2022	163	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.11	0.1
7/29/2022	164	215	Door	Wood	Light Blue	Intact	Negative	<LOD	0.03
7/29/2022	165	212	Wall	Plaster	Beige	Intact	Negative	<LOD	0.03
7/29/2022	166	212	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
7/29/2022	167	212	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
7/29/2022	168	212	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01

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MONTROSE ENVIRONMENTAL

Table 2
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Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/29/2022	169	212	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.05
7/29/2022	170	212	Window Sill	Wood	Beige	Intact	Negative	<LOD	0.06
7/29/2022	171	212	Window Sill	Wood	Beige	Intact	Negative	0.06	0.04
7/29/2022	172	212	Window Sill	Wood	Beige	Intact	Negative	<LOD	0.03
7/29/2022	173	2nd Fl Hall Main	Wall	Plaster	Beige	Intact	Negative	0.13	0.07
7/29/2022	174	2nd Fl Hall Main	Wall	Plaster	Beige	Intact	Negative	0.5	0.1
7/29/2022	175	2nd Fl Hall Main	Wall	Plaster	Beige	Intact	Negative	0.14	0.07
7/29/2022	176	2nd Fl Hall Main	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	177	2nd Fl Hall Main	Wall	Brick	Beige	Intact	Negative	0.28	0.06
7/29/2022	178	207	Wall	Plaster	Beige	Intact	Negative	<LOD	0.04
7/29/2022	179	207	Wall	Plaster	Beige	Intact	Negative	<LOD	0.02
7/29/2022	180	207	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	181	207	Wall	Plaster	Beige	Intact	Negative	0.03	0.01
7/29/2022	182	207	Wall	Plaster	Beige	Intact	Negative	0.07	0.04
7/29/2022	183	207	Chalkboard Frame	Wood	Beige	Intact	Negative	<LOD	0.02
7/29/2022	184	207	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.03
7/29/2022	185	207	Window Sill	Wood	Beige	Intact	Negative	0.07	0.04
7/29/2022	186	207	Window Sill	Wood	Beige	Intact	Negative	<LOD	0.04
7/29/2022	187	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.1	0.1
7/29/2022	188	Science Hall Ramp	Wall	Brick	Beige	Intact	Negative	0.44	0.18
7/29/2022	189	Science Hall Ramp	Wall	Brick	Beige	Intact	Negative	0.13	0.06
7/29/2022	190	Science Hall Ramp	Wall	Brick	Beige	Intact	Negative	<LOD	0.02
7/29/2022	191	Science Hall Ramp	Wall	Drywall	Beige	Intact	Negative	0.04	0.01
7/29/2022	192	Science Hall Ramp	Wall	Concrete	Beige	Intact	Negative	0.07	0.02
7/29/2022	193	Science Hall Ramp	Wall	Concrete	Beige	Intact	Negative	0.06	0.03
7/29/2022	194	Science Hall Ramp	Wall	Concrete	Beige	Intact	Negative	0.21	0.05
7/29/2022	195	Science Hall Ramp	Wall	Drywall	Beige	Intact	Negative	0.05	0.01
7/29/2022	196	Science Hall Ramp	Wall	Brick	Beige	Intact	Negative	0.06	0.04

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/29/2022	197	201	Wall	Concrete	Beige	Intact	Negative	0.06	0.02
7/29/2022	198	201	Wall	Concrete	Beige	Intact	Negative	0.08	0.01
7/29/2022	199	201	Wall	Concrete	Beige	Intact	Negative	0.09	0.01
7/29/2022	200	201	Wall	Concrete	Beige	Intact	Negative	0.05	0.01
7/29/2022	201	Calibration	Red Film	Film	Red	Intact	Positive	1.24	0.1
7/29/2022	202	200	Wall	Drywall	Beige	Intact	Negative	0.08	0.01
7/29/2022	203	200	Wall	Drywall	Beige	Intact	Negative	0.07	0.02
7/29/2022	204	200	Wall	Drywall	Beige	Intact	Negative	0.04	0.01
7/29/2022	205	200	Wall	Concrete	Beige	Intact	Negative	0.07	0.01
7/29/2022	206	200	Window Sill	Wood	Beige	Intact	Negative	0.41	0.1
7/29/2022	207	200	Window Sill	Wood	Beige	Intact	Negative	0.31	0.1
7/29/2022	208	200	Window Sill	Wood	Beige	Intact	Negative	0.37	0.1
7/29/2022	**209**	**202**	**Window Frame**	**Wood**	**Beige**	**Fair**	**Positive**	**15.02**	**1.27**
7/29/2022	210	202	Window Box Cover	Wood	Beige	Intact	Negative	0.14	0.01
7/29/2022	211	Science Hall W Restroom	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	212	Science Hall W Restroom	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
7/29/2022	213	Science Hall W Restroom	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	214	Science Hall W Restroom	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	215	Science Hall W Restroom	Window Sill	Wood	Beige	Intact	Negative	<LOD	0.01
7/29/2022	216	Science Hall Stairwell	Wainscoting	Concrete	Beige	Intact	Negative	<LOD	0.01
7/29/2022	217	Science Hall Stairwell	Wainscoting	Concrete	Beige	Intact	Negative	<LOD	0.01
7/29/2022	218	Science Hall Stairwell	Wainscoting	Concrete	Beige	Intact	Negative	<LOD	0.01
7/29/2022	219	Science Hall Stairwell	Wainscoting	Concrete	Beige	Intact	Negative	<LOD	0.01
7/29/2022	220	Science Hall Stairwell	Railing	Metal	Blue	Intact	Negative	<LOD	0.01
7/29/2022	221	Science Hall Stairwell	Stringer	Metal	Blue	Intact	Negative	<LOD	0.01
7/29/2022	222	Science Hall Stairwell	Riser	Metal	Blue	Intact	Negative	<LOD	0.01
7/29/2022	223	Calibration	Red Film	Film	Red	Intact	Inconclusive	0.96	0.1
7/29/2022	224	Calibration	Red Film	Film	Red	Intact	Positive	1.18	0.1

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/29/2022	225	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.03	0.1
7/29/2022	226	Standardization					PASS		
7/29/2022	227	Calibration	Red Film	Film	Red	Intact	Inconclusive	0.93	0.1
7/29/2022	228	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.05	0.1
7/29/2022	229	Calibration	Red Film	Film	Red	Intact	Inconclusive	0.94	0.1
7/29/2022	230	Exterior	Library Window	Wood	White	Intact	Negative	<LOD	0.01
7/29/2022	231	Exterior	Library Window	Wood	White	Intact	Negative	<LOD	0.01
7/29/2022	232	Exterior	Door 03 Frame	Wood	White	Fair	Negative	0.46	0.13
7/29/2022	**233**	**Exterior**	**Door 03 Frame**	**Wood**	**White**	**Fair**	**Positive**	**2.05**	**0.33**
7/29/2022	**234**	**Exterior**	**Door 02 Frame**	**Wood**	**White**	**Intact**	**Positive**	**2.78**	**0.55**
7/29/2022	235	Exterior	Door 01 Frame	Wood	White	Intact	Negative	0.02	0.01
7/29/2022	236	Exterior	Door 01 Frame	Wood	White	Intact	Negative	0.22	0.1
7/29/2022	237	Exterior	Door 01 Frame	Wood	White	Intact	Negative	0.06	0.04
7/29/2022	238	Exterior	Door 01 Frame	Wood	White	Intact	Negative	0.05	0.03
7/29/2022	239	Exterior	Door 01 Frame	Wood	White	Intact	Negative	0.35	0.1
7/29/2022	240	Exterior	Door 01 Frame	Wood	White	Intact	Inconclusive	0.87	0.11
7/29/2022	241	Exterior	Door 01 Frame	Wood	White	Intact	Inconclusive	1.13	0.14
7/29/2022	242	Exterior	Door 01 Frame	Wood	White	Intact	Negative	0.22	0.06
7/29/2022	243	Exterior	Door 01 Frame	Wood	White	Intact	Negative	<LOD	0.09
7/29/2022	244	Exterior	Door 01 Frame	Wood	White	Intact	Inconclusive	0.86	0.12
7/29/2022	245	Exterior	Door 08	Wood	White	Fair	Inconclusive	0.97	0.15
7/29/2022	**246**	**Exterior**	**Door 08**	**Wood**	**White**	**Intact**	**Positive**	**2.04**	**0.34**
7/29/2022	247	Exterior	Door 102	Wood	White	Intact	Negative	0.62	0.21
7/29/2022	248	Exterior	Door 102	Wood	White	Intact	Negative	0.59	0.1
7/29/2022	249	Exterior	Door 102	Wood	White	Fair	Negative	0.85	0.1
7/29/2022	**250**	**Exterior**	**Door 102**	**Wood**	**White**	**Intact**	**Positive**	**2.26**	**0.35**
7/29/2022	251	116	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	252	116	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/29/2022	253	116	Wall	Drywall	Beige	Intact	Negative	<LOD	0.02
7/29/2022	254	116	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	255	116 Hall	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	256	116 Hall	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	257	116 Hall	Wall	Brick	Beige	Intact	Negative	<LOD	0.02
7/29/2022	258	116 Hall	Wall	Drywall	Beige	Intact	Negative	0.04	0.02
7/29/2022	259	116 Hall	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	260	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.11	0.1
7/29/2022	261	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.04	0.1
7/29/2022	262	Calibration	Red Film	Film	Red	Intact	Positive	1.15	0.1
8/2/2022	280	Standardization					Pass		
8/2/2022	281	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.07	0.1
8/2/2022	282	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.02	0.1
8/2/2022	283	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.08	0.1
8/2/2022	284	114	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	285	114	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	286	114	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	**287**	**114**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**5.29**	**1.27**
8/2/2022	**288**	**114**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**6.08**	**0.9**
8/2/2022	289	114	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	290	114	Wall	Drywall	Beige	Intact	Negative		
8/2/2022	291	Storage Across 114	Wall	Concrete	Beige	Intact	Negative	0.02	0.01
8/2/2022	292	Storage Across 114	Wall	Concrete	Beige	Intact	Negative	<LOD	0.34
8/2/2022	293	Storage Across 114	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
8/2/2022	294	Storage Across 114	Wall	Concrete	Beige	Intact	Negative	0.02	0.01
8/2/2022	295	Hall	Floor	Concrete	Gray	Intact	Negative	<LOD	0.04
8/2/2022	296	Hall	Wall	Plaster	Beige	Intact	Negative	<LOD	0.04
8/2/2022	297	Hall	Wall	Plaster	Beige	Intact	Negative	<LOD	0.1

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/2/2022	298	Hall	Wall	Drywall	Beige	Intact	Negative	<LOD	0.11
8/2/2022	299	Hall	Wall	Drywall	Beige	Intact	Negative	<LOD	0.45
8/2/2022	300	Hall	Wall	Drywall	Beige	Intact	Inconclusive	2.32	1.14
8/2/2022	301	Hall	Wall	Drywall	Beige	Intact	Negative	0.24	0.14
8/2/2022	302	Hall	Wall	Plaster	Beige	Intact	Negative	<LOD	0.24
8/2/2022	303	Hall	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	304	112	Door Frame	Drywall	Blue	Intact	Negative	<LOD	0.01
8/2/2022	305	112	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	306	112	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	307	112	Wall	Plaster	Beige	Intact	Negative	<LOD	0.1
8/2/2022	308	112	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	309	112	Wall	Drywall	Beige	Intact	Negative	<LOD	0.45
8/2/2022	310	112	Wall	Plaster	Beige	Intact	Negative	<LOD	0.11
8/2/2022	311	112	Wall	Plaster	Beige	Intact	Negative	<LOD	0.1
8/2/2022	312	112	Wall	Drywall	Beige	Intact	Negative	0.03	0.01
8/2/2022	313	112	Wall	Drywall	White	Intact	Negative	<LOD	0.01
8/2/2022	314	112	Wall	Drywall	Beige	Intact	Negative	0.04	0.01
8/2/2022	315	112	Archway	Plaster	Beige	Intact	Inconclusive	<LOD	4.21
8/2/2022	**316**	**By 112**	**Archway**	**Plaster**	**Beige**	**Fair**	**Positive**	**4.86**	**1.94**
8/2/2022	**317**	**By 112**	**Archway**	**Plaster**	**Beige**	**Fair**	**Positive**	**5.47**	**1.9**
8/2/2022	318	By 112	Archway	Plaster	Beige	Intact	Inconclusive	<LOD	0.79
8/2/2022	319	By 112	Archway	Plaster	Beige	Intact	Inconclusive	<LOD	1.74
8/2/2022	**320**	**By 112**	**Archway**	**Wood**	**Beige**	**Fair**	**Positive**	**4.27**	**1.62**
8/2/2022	**321**	**By 112**	**Archway**	**Wood**	**Beige**	**Fair**	**Positive**	**2.69**	**0.8**
8/2/2022	322	By 112	Archway	Wood	Beige	Intact	Inconclusive	<LOD	2.55
8/2/2022	**323**	**By 112**	**Archway**	**Wood**	**Beige**	**Fair**	**Positive**	**2.26**	**0.6**
8/2/2022	**324**	**By 112**	**Baseboard**	**Wood**	**White**	**Fair**	**Positive**	**4.92**	**1.71**
8/2/2022	325	By 112	Baseboard	Wood	White	Intact	Inconclusive	<LOD	7.24

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/2/2022	**326**	**By 112**	**Baseboard**	**Wood**	**White**	**Fair**	**Positive**	**5.65**	**2.23**
8/2/2022	**327**	**By 112**	**Baseboard**	**Wood**	**White**	**Fair**	**Positive**	**3.67**	**1.4**
8/2/2022	328	Stairs By 112	Stringer	Metal	Beige	Intact	Inconclusive	<LOD	3.48
8/2/2022	**329**	**Stairs By 112**	**Stringer**	**Metal**	**Beige**	**Fair**	**Positive**	**5.56**	**1.85**
8/2/2022	330	Stairs By 112	Stringer	Metal	Beige	Intact	Inconclusive	<LOD	4.82
8/2/2022	**331**	**Stairs By 112**	**Stringer**	**Metal**	**Beige**	**Fair**	**Positive**	**4.07**	**1.25**
8/2/2022	332	Stairs By 112	Riser	Concrete	Black	Intact	Inconclusive	0.95	0.17
8/2/2022	333	Stairs By 112	Riser	Concrete	Black	Intact	Negative	<LOD	0.44
8/2/2022	**334**	**Stairs By 112**	**Riser**	**Concrete**	**Black**	**Fair**	**Positive**	**1.58**	**0.3**
8/2/2022	335	Stairs By 112	Riser	Concrete	Black	Intact	Negative	0.37	0.21
8/2/2022	**336**	**Stairs By 112**	**Door Frame**	**Concrete**	**White**	**Fair**	**Positive**	**3.76**	**1.2**
8/2/2022	337	Stairs By 112	Door Frame	Concrete	White	Intact	Inconclusive	2.36	1.34
8/2/2022	**338**	**Stairs By 112**	**Door Frame**	**Wood**	**White**	**Fair**	**Positive**	**7**	**2.63**
8/2/2022	339	Stairs By 112	Door Frame	Metal	White	Intact	Negative	0.02	0.01
8/2/2022	340	Stairs By 112	Window Sill	Wood	Beige	Intact	Negative	<LOD	0.52
8/2/2022	341	Stairs By 112	Window Sill	Wood	Beige	Intact	Inconclusive	1.72	0.66
8/2/2022	342	Stairs By 112	Window Sill	Wood	Beige	Intact	Negative	<LOD	0.37
8/2/2022	343	Stairs By 109	Baseboard	Concrete	Black	Intact	Negative	<LOD	0.15
8/2/2022	344	109	Door Frame	Metal	Blue	Intact	Negative	0.03	0.01
8/2/2022	345	109	Closet Jamb	Metal	Blue	Intact	Negative	<LOD	0.04
8/2/2022	346	109	Door	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	347	109	Door Frame	Metal	Blue	Intact	Negative	0.03	0.01
8/2/2022	348	109	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.04
8/2/2022	349	109	Door Header	Metal	Blue	Intact	Negative	0.03	0.01
8/2/2022	350	109	Wall	Plaster	Beige	Intact	Negative	0.05	0.01
8/2/2022	351	109	Wall	Plaster	Beige	Intact	Negative	<LOD	0.45
8/2/2022	352	109	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
8/2/2022	353	109	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/2/2022	354	109	Wall	Plaster	Beige	Intact	Negative	<LOD	0.08
8/2/2022	355	109	Wall	Wood	Beige	Intact	Negative	<LOD	0.04
8/2/2022	356	109	Wall	Plaster	Blue	Intact	Negative	<LOD	0.1
8/2/2022	357	Main Office 110-3	Door Frame	Plaster	Red	Intact	Negative	<LOD	0.01
8/2/2022	358	Main Office 110-3	Door Header	Plaster	Red	Intact	Negative	<LOD	0.01
8/2/2022	359	Main Office 110-3	Door Frame	Metal	Red	Intact	Negative	<LOD	0.03
8/2/2022	360	Main Office 110-3	Door Jamb	Metal	Red	Intact	Negative	<LOD	0.01
8/2/2022	361	Main Office 110-3	Wall	Drywall	Beige	Intact	Negative	<LOD	0.03
8/2/2022	362	Main Office 110-3	Wall	Drywall	Beige	Intact	Negative	0.03	0.01
8/2/2022	363	Main Office 110-3	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	364	Main Office 110-3	Wall	Drywall	Beige	Intact	Negative	0.03	0.01
8/2/2022	365	Main Office 110-3	Wall	Drywall	Beige	Intact	Negative	<LOD	0.03
8/2/2022	366	Main Office 110-3	Window Sill	Wood	Red	Intact	Positive	1.57	0.38
8/2/2022	**367**	**Main Office 110-3**	**Window Sill**	**Wood**	**Red**	**Intact**	**Positive**	**1.83**	**0.49**
8/2/2022	368	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	1.14	0.13
8/2/2022	369	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	1.05	0.56
8/2/2022	370	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	2.44
8/2/2022	371	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	0.9
8/2/2022	372	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	1.27
8/2/2022	373	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	0.69
8/2/2022	374	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	1.13
8/2/2022	**375**	**Main Office 110-3**	**Window Sill**	**Wood**	**Red**	**Intact**	**Positive**	**2.13**	**0.52**
8/2/2022	376	Main Office 110-3	Window Sill	Wood	Red	Intact	Negative	<LOD	0.58
8/2/2022	377	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	1.22
8/2/2022	378	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	1.47	0.58
8/2/2022	379	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	0.98	0.6
8/2/2022	380	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	0.74
8/2/2022	381	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	0.93

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8/2/2022	382	Main Office 110-3	Window Sill	Wood	Red	Intact	Negative	<LOD	0.64
8/2/2022	383	107	Wainscoting	Plaster	Beige	Intact	Negative	<LOD	0.08
8/2/2022	384	107	Wainscoting	Plaster	Beige	Intact	Negative	<LOD	0.15
8/2/2022	385	107	Wainscoting	Plaster	Beige	Intact	Negative	<LOD	0.04
8/2/2022	386	107	Wainscoting	Plaster	Beige	Intact	Negative	<LOD	0.1
8/2/2022	387	Br By 110	Wall	Plaster	Beige	Intact	Negative	0.05	0.01
8/2/2022	388	Br By 110	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
8/2/2022	389	Br By 110	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
8/2/2022	390	Br By 110	Wall	Plaster	Beige	Intact	Negative	<LOD	0.76
8/2/2022	391	Br By 110	Baseboard	Wood	Red	Intact	Negative	<LOD	0.04
8/2/2022	392	Hall By 110	Column	Wood	Beige	Intact	Inconclusive	<LOD	0.65
8/2/2022	393	Hall By 110	Column	Wood	Beige	Intact	Negative	<LOD	0.61
8/2/2022	394	Hall By 110	Column	Wood	Beige	Intact	Inconclusive	<LOD	4.19
8/2/2022	395	Hall By 110	Column	Wood	Beige	Intact	Inconclusive	<LOD	2.43
8/2/2022	396	Hall By 110	Column	Wood	Beige	Intact	Inconclusive	<LOD	1.69
8/2/2022	397	Hall By 110	Column	Wood	Beige	Intact	Inconclusive	<LOD	1.1
8/2/2022	398	Hall By 110	Column	Wood	Beige	Intact	Negative	<LOD	0.37
8/2/2022	399	Mech Rm	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	400	Mech Rm	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	401	Mech Rm	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
8/2/2022	402	Mech Rm	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	403	Elec Rm	Wall	Plaster	Beige	Intact	Negative	<LOD	0.2
8/2/2022	404	Elec Rm	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	405	Elec Rm	Wall	Plaster	Beige	Intact	Negative	<LOD	0.05
8/2/2022	406	Elec Rm	Wall	Plaster	Beige	Intact	Negative	<LOD	0.11
8/2/2022	407	Elevator Area	Door Frame	Metal	Blue	Intact	Negative	0.02	0.01
8/2/2022	408	Elevator Area	Door Jamb	Metal	Blue	Intact	Negative	0.02	0.01
8/2/2022	409	Elevator Area	Door	Wood	Blue	Intact	Negative	0.02	0.01

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MONTROSE ENVIRONMENTAL

Table 2
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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/2/2022	410	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	<LOD	0.78
8/2/2022	**411**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**4.69**	**1.93**
8/2/2022	412	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	<LOD	2.93
8/2/2022	**413**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**3.55**	**1.21**
8/2/2022	**414**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**3.97**	**1.54**
8/2/2022	415	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	3.21	1.95
8/2/2022	**416**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**3.56**	**1.33**
8/2/2022	417	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	<LOD	1.28
8/2/2022	418	Main Entrance	Trim	Wood	Beige	Intact	Negative	<LOD	0.45
8/2/2022	**419**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**3.98**	**1.62**
8/2/2022	**420**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**3.7**	**1.33**
8/2/2022	**421**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**3.94**	**1.57**
8/2/2022	422	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	<LOD	0.84
8/2/2022	423	Main Entrance	Trim	Wood	Beige	Intact	Negative	<LOD	0.58
8/2/2022	**424**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**5.89**	**2.44**
8/2/2022	**425**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**2.29**	**0.42**
8/2/2022	426	Main Entrance	Trim	Wood	Beige	Intact	Negative	<LOD	0.26
8/2/2022	427	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	<LOD	1.78
8/2/2022	428	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	<LOD	3.53
8/2/2022	**429**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**7.35**	**3.09**
8/2/2022	430	105	Wall	Drywall	Beige	Intact	Inconclusive	<LOD	0.8
8/2/2022	431	105	Wall	Drywall	Beige	Intact	Negative	0.07	0.01
8/2/2022	432	105	Wall	Plaster	Beige	Intact	Negative	0.07	0.01
8/2/2022	433	105	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
8/2/2022	434	105	Wall	Drywall	Beige	Intact	Negative	0.09	0.01
8/2/2022	435	108-1	Wall	Drywall	Beige	Intact	Negative	0.11	0.01
8/2/2022	436	108-1	Wall	Drywall	Beige	Intact	Negative	<LOD	0.58
8/2/2022	437	108-1	Wall	Plaster	Beige	Intact	Negative	0.14	0.01

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/2/2022	438	108-1	Wall	Drywall	Beige	Intact	Negative	0.07	0.01
8/2/2022	439	108-1	Door Frame	Drywall	Green	Intact	Negative	0.02	0.01
8/2/2022	440	108-1	Door Frame	Metal	Green	Intact	Negative	0.07	0.01
8/2/2022	441	108-1	Door Jamb	Metal	Green	Intact	Negative	<LOD	0.01
8/2/2022	442	108-2	Wall	Drywall	Blue	Intact	Negative	<LOD	0.01
8/2/2022	443	108-2	Wall	Drywall	Blue	Intact	Negative	<LOD	0.01
8/2/2022	444	108-2	Wall	Drywall	Blue	Intact	Negative	<LOD	0.25
8/2/2022	445	108-2	Wall	Drywall	Blue	Intact	Negative	<LOD	0.01
8/2/2022	446	108	Trim	Wood	White	Intact	Negative	<LOD	0.01
8/2/2022	447	Nurse 106	Door Frame	Metal	Green	Intact	Negative	<LOD	0.01
8/2/2022	448	Nurse 106	Door Jamb	Metal	Green	Intact	Negative	<LOD	0.23
8/2/2022	449	Nurse 106	Wall	Drywall	Beige	Intact	Negative	<LOD	0.48
8/2/2022	450	Nurse 106	Wall	Drywall	Beige	Intact	Negative	0.02	0.01
8/2/2022	451	Nurse 106	Wall	Drywall	Beige	Intact	Negative	0.03	0.01
8/2/2022	452	Nurse 106	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	453	Storage By 106	Wall	Plaster	Beige	Intact	Negative	0.03	0.01
8/2/2022	454	Storage By 106	Wall	Plaster	Beige	Intact	Negative	<LOD	0.04
8/2/2022	455	Storage By 106	Wall	Drywall	Beige	Intact	Negative	0.05	0.01
8/2/2022	456	Storage By 106	Wall	Plaster	Beige	Intact	Negative	<LOD	0.41
8/2/2022	457	Storage By 106	Door Frame	Plaster	Beige	Intact	Negative		
8/2/2022	458	Storage By 106	Door Frame	Metal	Blue	Intact	Negative	0.02	0.01
8/2/2022	459	Storage By 106	Door Jamb	Metal	Blue	Intact	Negative	0.02	0.01
8/2/2022	460	Cafe	Wall	Brick	Beige	Intact	Negative	<LOD	0.08
8/2/2022	461	Cafe	Wall	Brick	Beige	Intact	Negative	<LOD	0.38
8/2/2022	462	Cafe	Wall	Brick	Beige	Intact	Negative	<LOD	0.11
8/2/2022	463	Cafe	Wall	Brick	Beige	Intact	Negative	0.02	0.01
8/2/2022	464	Cafe	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	465	Kitchen 102	Door Frame	Metal	Blue	Intact	Negative	0.04	0.01

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8/2/2022	466	Kitchen 102	Door Jamb	Metal	Beige	Intact	Negative	<LOD	0.4
8/2/2022	467	Kitchen 102	Door Jamb	Metal	Beige	Intact	Negative	<LOD	0.01
8/2/2022	468	Kitchen 102	Wall	Drywall	Beige	Intact	Negative	0.06	0.01
8/2/2022	469	Kitchen 102	Wall	Brick	Beige	Intact	Negative	0.12	0.01
8/2/2022	470	Kitchen 102	Wall	Brick	Beige	Intact	Negative	<LOD	0.11
8/2/2022	471	Kitchen 102	Wall	Concrete	Beige	Intact	Negative	0.15	0.01
8/2/2022	472	Kitchen 102	Wall	Concrete	Beige	Intact	Negative	0.03	0.01
8/2/2022	473	Kitchen 102	Wall	Brick	Beige	Intact	Negative	<LOD	0.16
8/2/2022	474	103	Door Frame	Brick	Blue	Intact	Negative	0.09	0.01
8/2/2022	475	103	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.3
8/2/2022	476	103	Door Jamb	Metal	Blue	Intact	Negative	0.09	0.01
8/2/2022	477	103	Wall	Concrete	Beige	Intact	Negative	0.14	0.01
8/2/2022	478	103	Wall	Concrete	Beige	Intact	Negative	0.11	0.05
8/2/2022	479	103	Wall	Concrete	Beige	Intact	Negative	0.19	0.01
8/2/2022	480	103	Wall	Concrete	Beige	Intact	Negative	0.36	0.2
8/2/2022	481	103	Wall	Concrete	Beige	Intact	Negative	0.06	0.02
8/2/2022	482	103	Tread	Metal	Blue	Intact	Negative	0.03	0.01
8/2/2022	483	103 Hallway	Floor	Concrete	Gray	Intact	Negative	0.14	0.03
8/2/2022	484	103 Hallway	Floor	Concrete	Gray	Intact	Negative	0.29	0.06
8/2/2022	485	103 Hallway	Wall	Plaster	Beige	Intact	Negative	0.56	0.2
8/2/2022	486	103 Hallway	Wall	Plaster	Beige	Intact	Negative	<LOD	0.33
8/2/2022	487	103 Hallway	Wall	Plaster	Beige	Intact	Negative	<LOD	0.39
8/2/2022	488	103 Hallway	Wall	Plaster	Beige	Intact	Negative	0.23	0.01
8/2/2022	489	103 Hallway	Wall	Drywall	Beige	Intact	Negative	0.43	0.1
8/2/2022	490	103 Hallway	Wall	Drywall	Beige	Intact	Negative	0.45	0.1
8/2/2022	491	103 Hallway	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	492	103 Hallway	Wall	Brick	Beige	Intact	Negative	<LOD	0.17
8/2/2022	493	Music Rm 100	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.01

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/2/2022	494	Music Rm 100	Door Header	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	495	Music Rm 100	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	496	Music Rm 100	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	497	Music Rm 100	Wall	Concrete	Beige	Intact	Negative	0.02	0.01
8/2/2022	498	Music Rm 100	Wall	Concrete	Beige	Intact	Negative	<LOD	0.55
8/2/2022	499	Music Rm 100	Wall	Concrete	Beige	Intact	Inconclusive	<LOD	0.65
8/2/2022	**500**	**Music Rm 100**	**Wall**	**Brick**	**Beige**	**Intact**	**Positive**	**4.45**	**1.47**
8/3/2022	**501**	**Music Rm 100**	**Wall**	**Brick**	**Beige**	**Intact**	**Positive**	**3.47**	**1.22**
8/3/2022	**502**	**Music Rm 100**	**Wall**	**Brick**	**Beige**	**Intact**	**Positive**	**1.97**	**0.26**
8/3/2022	503	Music Rm 100	Wall	Brick	Beige	Intact	Inconclusive	<LOD	0.64
8/3/2022	504	Music Rm 100	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1.12
8/3/2022	505	Music Rm 100	Wall	Brick	Beige	Intact	Inconclusive	<LOD	3.74
8/3/2022	**506**	**Music Rm 100**	**Wall**	**Brick**	**Beige**	**Intact**	**Positive**	**2.6**	**0.99**
8/3/2022	507	Music Rm 100	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1.65
8/3/2022	508	Music Rm 100	Wall	Brick	Beige	Intact	Negative	<LOD	0.35
8/3/2022	509	Music Rm 100	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/3/2022	510	Music Rm 100	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
8/3/2022	511	Music Rm 100-A	Door Frame	Concrete	Red	Intact	Negative	<LOD	0.25
8/3/2022	512	Music Rm 100-A	Door Frame	Concrete	Red	Intact	Negative	<LOD	0.32
8/3/2022	513	Music Rm 100-A	Door Jamb	Concrete	Red	Intact	Negative	<LOD	0.01
8/3/2022	514	Music Rm 100-A	Door Header	Concrete	Red	Intact	Negative	<LOD	0.01
8/3/2022	515	Hall	Railing	Metal	Blue	Intact	Negative	<LOD	0.01
8/3/2022	516	Hall	Railing	Metal	Blue	Intact	Negative	0.02	0.01
8/3/2022	517	Calibration			Red	Intact	Inconclusive	1.02	0.1
8/3/2022	518	Calibration			Red	Intact	Inconclusive	1.01	0.1
8/3/2022	519	Calibration			Red	Intact	Inconclusive	0.96	0.1
8/3/2022	520					Intact			
8/3/2022	521	Calibration			Red	Intact	Inconclusive	1.08	0.1

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8/3/2022	522	Calibration			Red	Intact	Inconclusive	1.01	0.1
8/3/2022	523	Calibration			Red	Intact	Inconclusive	0.98	0.1
8/3/2022	524	Mech Rm Platform	Platform	Concrete	Beige	Intact	Negative	<LOD	0.01
8/3/2022	**525**	**Basement By Front St**	**Door Frame**	**Concrete**	**Beige**	**Intact**	**Positive**	**1.54**	**0.28**
8/3/2022	**526**	**Basement By Front St**	**Door Frame**	**Concrete**	**Beige**	**Intact**	**Positive**	**2.21**	**0.59**
8/3/2022	527	Basement By Front St	Door Frame	Concrete	Beige	Intact	Inconclusive	<LOD	0.79
8/3/2022	528	Basement By Front St	Door Frame	Concrete	Beige	Intact	Inconclusive	<LOD	1.23
8/3/2022	529	Basement By Front St	Door Frame	Concrete	Beige	Intact	Inconclusive	<LOD	0.68
8/3/2022	530	Basement By Front St	Door Frame	Concrete	Beige	Intact	Negative	<LOD	0.64
8/3/2022	531	Basement By Front St	Door Frame	Metal	Beige	Intact	Inconclusive	1.24	0.24
8/3/2022	**532**	**Basement By Front St**	**Door Frame**	**Metal**	**Beige**	**Fair**	**Positive**	**1.48**	**0.31**
8/3/2022	**533**	**Basement By Front St**	**Door Frame**	**Metal**	**Beige**	**Fair**	**Positive**	**1.68**	**0.4**
8/3/2022	**534**	**Basement By Front St**	**Door Jamb**	**Metal**	**Beige**	**Fair**	**Positive**	**2.06**	**0.47**
8/3/2022	**535**	**Basement By Front St**	**Door Jamb**	**Metal**	**Beige**	**Fair**	**Positive**	**2.47**	**0.45**
8/3/2022	**536**	**Basement By Front St**	**Door**	**Wood**	**Beige**	**Fair**	**Positive**	**2.36**	**0.55**
8/3/2022	**537**	**Basement By Front St**	**Door**	**Wood**	**Beige**	**Fair**	**Positive**	**2.87**	**1.23**
8/3/2022	**538**	**Basement By Front St**	**Door**	**Wood**	**Beige**	**Fair**	**Positive**	**2.19**	**0.62**
8/3/2022	539	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.12
8/3/2022	540	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.14
8/3/2022	541	Basement By Front St	Wall	Brick	Beige	Intact	Negative	<LOD	0.07
8/3/2022	542	Basement By Front St	Door Frame	Brick	Red	Intact	Negative	0.49	0.18
8/3/2022	543	Basement By Front St	Door Frame	Brick	Red	Intact	Negative	0.45	0.24
8/3/2022	544	Basement By Front St	Door Frame	Wood	Red	Intact	Inconclusive	0.8	0.24
8/3/2022	545	Basement By Front St	Door Frame	Wood	Red	Intact	Inconclusive	0.93	0.18
8/3/2022	546	Basement By Front St	Door Frame	Wood	Red	Intact	Negative	0.45	0.26
8/3/2022	547	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	0.67	0.43
8/3/2022	548	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	1.06	0.2
8/3/2022	549	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	0.88	0.53

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8/3/2022	550	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	<LOD	1.54
8/3/2022	551	Basement By Front St	Door Frame	Metal	Red	Intact	Negative	<LOD	0.47
8/3/2022	552	Basement By Front St	Door	Wood	Red	Intact	Inconclusive	0.58	0.35
8/3/2022	553	Basement By Front St	Door	Wood	Red	Intact	Positive	1.34	0.22
8/3/2022	**554**	**Basement By Front St**	**Door**	**Wood**	**Red**	**Fair**	**Positive**	**1.24**	**0.11**
8/3/2022	**555**	**Basement By Front St**	**Door**	**Wood**	**Red**	**Fair**	**Positive**	**1.22**	**0.1**
8/3/2022	556	Basement By Front St	Door	Metal	Red	Intact	Inconclusive	1.32	0.22
8/3/2022	**557**	**Basement By Front St**	**Door**	**Metal**	**Red**	**Fair**	**Positive**	**1.36**	**0.21**
8/3/2022	558	Basement By Front St	Door	Wood	White	Poor	Inconclusive	0.95	0.24
8/3/2022	559	Basement By Front St	Door	Wood	White	Poor	Inconclusive	0.89	0.59
8/3/2022	560	Basement By Front St	Door	Wood	White	Poor	Inconclusive	<LOD	1.08
8/3/2022	561	Basement By Front St	Door	Wood	White	Poor	Negative	<LOD	0.59
8/3/2022	562	Basement By Front St	Door	Wood	White	Poor	Negative	<LOD	0.61
8/3/2022	563	Basement By Front St	Door	Wood	White	Poor	Inconclusive	<LOD	0.81
8/3/2022	564	Basement By Front St	Door	Wood	White	Poor	Inconclusive	<LOD	0.75
8/3/2022	565	Basement By Front St	Door	Wood	White	Poor	Inconclusive	<LOD	0.93
8/3/2022	566	Basement By Front St	Door	Wood	White	Poor	Inconclusive	<LOD	0.88
8/3/2022	567	Basement By Front St	Door	Wood	White	Poor	Negative	<LOD	0.54
8/3/2022	568	Basement By Front St	Door Frame	Wood	White	Intact	Inconclusive	<LOD	0.92
8/3/2022	569	Basement By Front St	Door Frame	Wood	White	Intact	Negative	<LOD	0.64
8/3/2022	570	Basement By Front St	Door Jamb	Wood	White	Intact	Inconclusive	<LOD	0.99
8/3/2022	571	Basement By Front St	Door Jamb	Wood	White	Intact	Negative	<LOD	0.46
8/3/2022	572	Basement By Front St	Wall	Brick	White	Intact	Negative	<LOD	0.1
8/3/2022	573	Basement By Front St	Wall	Brick	White	Intact	Negative	<LOD	0.1
8/3/2022	574	Basement By Front St	Wall	Concrete	White	Intact	Negative	<LOD	0.31
8/3/2022	575	Basement By Front St	Wall	Concrete	White	Intact	Negative	<LOD	0.5
8/3/2022	576	Basement By Front St	Wall	Concrete	White	Intact	Negative	<LOD	0.1
8/3/2022	577	Basement By Front St	Door	Wood	Green	Intact	Negative	<LOD	0.06

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8/3/2022	578	Basement By Front St	Door	Wood	Tan	Intact	Negative	<LOD	0.1
8/3/2022	579	Basement By Front St	Door	Wood	Tan	Intact	Inconclusive	0.92	0.25
8/3/2022	580	Basement By Front St	Door	Wood	Green	Intact	Negative	<LOD	0.49
8/3/2022	581	Basement By Front St	Door	Concrete	Tan	Intact	Negative	<LOD	0.08
8/3/2022	582	Basement By Front St	Door	Concrete	Tan	Intact	Negative	<LOD	0.13
8/3/2022	583	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.1
8/3/2022	584	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.08
8/3/2022	585	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.11
8/3/2022	586	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.06
8/3/2022	587	Basement By Front St	Wall	Brick	Tan	Intact	Negative	<LOD	0.04
8/3/2022	588	Basement By Front St	Door Frame	Brick	Red	Intact	Inconclusive	1.12	0.1
8/3/2022	589	Basement By Front St	Door Frame	Brick	Red	Intact	Inconclusive	0.69	0.37
8/3/2022	590	Basement By Front St	Door Frame	Brick	Red	Intact	Inconclusive	<LOD	0.86
8/3/2022	591	Basement By Front St	Door Frame	Brick	Red	Intact	Inconclusive	0.98	0.27
8/3/2022	592	Basement By Front St	Door Frame	Brick	Red	Intact	Inconclusive	<LOD	0.92
8/3/2022	593	Basement By Front St	Door Frame	Brick	Red	Intact	Inconclusive	1.16	0.11
8/3/2022	**594**	**Basement By Front St**	**Door Frame**	**Brick**	**Red**	**Poor**	**Positive**	**1.36**	**0.22**
8/3/2022	595	Basement By Front St	Door Header	Brick	Red	Intact	Negative	0.41	0.26
8/3/2022	596	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	1.24	0.2
8/3/2022	597	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	1.08	0.19
8/3/2022	598	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	1.02	0.24
8/3/2022	**599**	**Basement By Front St**	**Door Frame**	**Metal**	**Red**	**Poor**	**Positive**	**1.89**	**0.54**
8/3/2022	600	Basement By Front St	Door Header	Metal	Red	Intact	Inconclusive	1.17	0.23
8/3/2022	601	Basement By Front St	Door Header	Metal	Red	Intact	Inconclusive	1.27	0.69
8/3/2022	602	Basement By Front St	Door Header	Wood	Red	Intact	Inconclusive	1.24	0.19
8/3/2022	603	Basement By Front St	Door Header	Wood	Red	Intact	Inconclusive	0.6	0.31
8/3/2022	604	Basement By Front St	Door Header	Wood	Red	Intact	Inconclusive	<LOD	1.17
8/3/2022	605	Basement By Front St	Door Header	Wood	Red	Intact	Inconclusive	<LOD	1.37

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Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	606	Basement By Front St	Door Header	Wood	Red	Intact	Inconclusive	1.2	0.57
8/3/2022	607	Basement By Front St	Door Jamb	Wood	Blue	Intact	Negative	0.55	0.27
8/3/2022	608	Basement By Front St	Door Jamb	Wood	Blue	Intact	Inconclusive	0.62	0.33
8/3/2022	**609**	**Basement By Front St**	**Door Jamb**	**Metal**	**Red**	**Fair**	**Positive**	**1.38**	**0.24**
8/3/2022	**610**	**Basement By Front St**	**Door Jamb**	**Metal**	**Red**	**Fair**	**Positive**	**1.53**	**0.33**
8/3/2022	611	Basement By Front St	Door Header	Wood	Red	Intact	Inconclusive	1.01	0.1
8/3/2022	612	Basement By Front St	Door Frame	Wood	Red	Intact	Inconclusive	2.23	1.07
8/3/2022	613	Basement By Front St	Door Frame	Wood	Red	Intact	Inconclusive	1.22	0.28
8/3/2022	614	Basement By Front St	Door Frame	Wood	Red	Intact	Negative	0.52	0.27
8/3/2022	**615**	**Basement By Front St**	**Door**	**Wood**	**Red**	**Fair**	**Positive**	**1.53**	**0.27**
8/3/2022	**616**	**Basement By Front St**	**Door**	**Wood**	**Red**	**Fair**	**Positive**	**1.26**	**0.11**
8/3/2022	617	Basement By Front St	Wall	Concrete	Beige	Intact	Inconclusive	0.81	0.18
8/3/2022	**618**	**Basement By Front St**	**Wall**	**Concrete**	**Beige**	**Fair**	**Positive**	**3.06**	**0.99**
8/3/2022	**619**	**Basement By Front St**	**Wall**	**Concrete**	**Beige**	**Fair**	**Positive**	**6.79**	**0.82**
8/3/2022	**620**	**Basement By Front St**	**Wall**	**Concrete**	**Beige**	**Fair**	**Positive**	**22.8**	**2.75**
8/3/2022	621	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.04
8/3/2022	622	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.07
8/3/2022	623	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.09
8/3/2022	624	Basement By Front St	Wall	Brick	Beige	Intact	Negative	<LOD	0.01
8/3/2022	625	Basement By Front St	Wall	Concrete	Gray	Intact	Negative	<LOD	0.07
8/3/2022	626	Basement By Front St	Wall	Concrete	Gray	Intact	Negative	<LOD	0.12
8/3/2022	627	Basement By Front St	Wall	Brick	Gray	Intact	Negative	<LOD	0.05
8/3/2022	628	Basement By Front St	Wall	Concrete	White	Intact	Negative	<LOD	0.09
8/3/2022	629	Basement By Front St	Wall	Concrete	White	Intact	Negative	<LOD	0.1
8/3/2022	630	Basement By Front St	Door	Concrete	White	Intact	Negative	<LOD	0.32
8/3/2022	631	Basement By Front St	Door	Wood	White	Intact	Negative	<LOD	0.34
8/3/2022	632	Basement By Front St	Door Frame	Wood	White	Intact	Inconclusive	0.69	0.41
8/3/2022	633	Basement By Front St	Door Frame	Wood	White	Intact	Negative	<LOD	0.43

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Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	634	Basement By Front St	Door Frame	Wood	White	Intact	Inconclusive	<LOD	0.84
8/3/2022	635	Basement By Front St	Door Frame	Wood	White	Intact	Negative	<LOD	0.35
8/3/2022	636	Basement By Front St	Door Frame	Metal	Red	Intact	Negative	<LOD	0.13
8/3/2022	637	Basement By Front St	Door Frame	Metal	Red	Intact	Negative	<LOD	0.21
8/3/2022	638	Basement By Front St	Door Jamb	Metal	Red	Intact	Negative	<LOD	0.13
8/3/2022	639	Basement By Front St	Door	Metal	Gray	Intact	Negative	<LOD	0.01
8/3/2022	640	Basement By Front St	Wall	Concrete	Tan	Intact	Inconclusive	<LOD	1.02
8/3/2022	641	Basement By Front St	Wall	Concrete	Tan	Intact	Inconclusive	<LOD	1.01
8/3/2022	642	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.51
8/3/2022	643	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.11
8/3/2022	644	Basement By Front St	Tread	Concrete	Black	Intact	Negative	<LOD	0.03
8/3/2022	645	Basement By Front St	Fireplace	Concrete	Gray	Intact	Negative	<LOD	0.03
8/3/2022	646	Basement By Front St	Floor	Concrete	Gray	Intact	Negative	<LOD	0.08
8/3/2022	647	Basement By Front St	Wall	Concrete	Gray	Intact	Negative	<LOD	0.16
8/3/2022	648	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.17
8/3/2022	649	Basement By Front St	Wall	Brick	Tan	Intact	Negative	<LOD	0.02
8/3/2022	650	Basement By Front St	Wall	Brick	Tan	Intact	Negative	<LOD	0.01
8/3/2022	651	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.44
8/3/2022	652	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.01
8/3/2022	**653**	**Basement By Front St**	**Wall**	**Concrete**	**Tan**	**Poor**	**Positive**	**4.98**	**2.23**
8/3/2022	**654**	**Basement By Front St**	**Wall**	**Concrete**	**Tan**	**Poor**	**Positive**	**6.73**	**2.44**
8/3/2022	655	Basement By Front St	Wall	Concrete	Tan	Poor	Negative	<LOD	0.06
8/3/2022	656	Basement By Front St	Wall	Concrete	Tan	Poor	Negative	<LOD	0.09
8/3/2022	657	Basement By Front St	Wall	Concrete	Tan	Poor	Negative	<LOD	0.13
8/3/2022	**658**	**Basement By Front St**	**Wall**	**Concrete**	**Tan**	**Poor**	**Positive**	**4.52**	**0.85**
8/3/2022	659	Basement By Front St	Door Jamb	Concrete	Blue	Intact	Negative	0.46	0.29
8/3/2022	660	Basement By Front St	Door Frame	Concrete	Blue	Intact	Negative	<LOD	0.08
8/3/2022	661	Basement By Front St	Door Header	Concrete	White	Intact	Positive	1.65	0.32

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Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	**662**	**Basement By Front St**	**Door Header**	**Metal**	**White**	**Fair**	**Positive**	**1.29**	**0.11**
8/3/2022	**663**	**Basement By Front St**	**Door Header**	**Metal**	**White**	**Fair**	**Positive**	**1.64**	**0.31**
8/3/2022	664	Basement By Front St	Door Frame	Metal	White	Intact	Inconclusive	1.05	0.24
8/3/2022	665	Basement By Front St	Door Frame	Metal	White	Intact	Negative	<LOD	0.38
8/3/2022	666	Basement By Front St	Door Frame	Metal	White	Intact	Inconclusive	1.4	0.31
8/3/2022	667	Basement By Front St	Door Frame	Metal	White	Intact	Inconclusive	0.83	0.37
8/3/2022	668	Basement By Front St	Column	Brick	Beige	Intact	Negative	<LOD	0.06
8/3/2022	669	Basement By Front St	Column	Brick	Beige	Intact	Negative	<LOD	0.06
8/3/2022	670	Basement By Front St	Column	Brick	Beige	Intact	Negative	<LOD	0.07
8/3/2022	671	Basement By Front St	Column	Brick	Beige	Intact	Negative	<LOD	0.03
8/3/2022	672	Basement By Front St	Wall	Brick	Beige	Intact	Negative	<LOD	0.06
8/3/2022	673	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.1
8/3/2022	674	Basement By Front St	Wall	Wood	Beige	Intact	Negative	<LOD	0.08
8/3/2022	675	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.03
8/3/2022	676	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
8/3/2022	677	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.07
8/3/2022	678	Basement By Front St	Floor	Concrete	Gray	Intact	Negative	<LOD	0.13
8/3/2022	679	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.04
8/3/2022	680	Basement By Front St	Wall	Brick	Beige	Intact	Negative	<LOD	0.04
8/3/2022	681	Basement By Front St	Wall	Brick	Beige	Intact	Negative	<LOD	0.03
8/3/2022	682	Basement By Front St	Wall	Brick	Beige	Intact	Negative	<LOD	0.12
8/3/2022	683	Basement By Front St	Wall	Brick	Green	Intact	Negative	<LOD	0.03
8/3/2022	684	Basement By Front St	Wall	Concrete	Green	Intact	Negative	<LOD	0.04
8/3/2022	685	Basement By Front St	Wall	Concrete	Green	Intact	Negative	<LOD	0.01
8/3/2022	686	Basement By Front St	Door	Concrete	White	Intact	Negative	<LOD	0.1
8/3/2022	687	Basement By Front St	Door	Wood	White	Intact	Negative	<LOD	0.08
8/3/2022	688	Basement By Front St	Door Frame	Wood	White	Intact	Negative	<LOD	0.01
8/3/2022	689	Basement By Front St	Door Jamb	Wood	White	Intact	Negative	<LOD	0.02

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	690	Basement By Front St	Window Sill	Wood	White	Intact	Negative	<LOD	0.09
8/3/2022	691	Basement By Back St	Door	Metal	Blue	Intact	Negative	<LOD	0.03
8/3/2022	692	Basement By Back St	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.01
8/3/2022	693	Basement By Back St	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.04
8/3/2022	694	Basement By Back St	Wall	Brick	Beige	Intact	Negative	<LOD	0.01
8/3/2022	695	Basement By Back St	Wall	Brick	Beige	Intact	Negative	<LOD	0.01
8/3/2022	696	Basement By Back St	Tread	Brick	Black	Intact	Negative	<LOD	0.08
8/3/2022	697	Basement By Back St	Tread	Brick	Black	Intact	Negative	<LOD	0.05
8/3/2022	698	Basement By Back St	Floor	Brick	Gray	Intact	Negative	<LOD	0.05
8/3/2022	699	Basement By Back St	Floor	Concrete	Gray	Intact	Negative	<LOD	0.09
8/3/2022	700	Basement By Back St	Tread	Metal	Black	Intact	Negative	<LOD	0.1
8/3/2022	701	Basement By Back St	Tread	Metal	Black	Intact	Negative	<LOD	0.04
8/3/2022	**702**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**4.67**	**1.49**
8/3/2022	703	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1.72
8/3/2022	704	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	2.99
8/3/2022	705	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	2.15
8/3/2022	706	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	3.01
8/3/2022	707	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1.87
8/3/2022	**708**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**6.48**	**2.66**
8/3/2022	**709**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**3.68**	**1.5**
8/3/2022	710	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1.8
8/3/2022	711	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1
8/3/2022	712	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1.07
8/3/2022	**713**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**6.17**	**2.52**
8/3/2022	**714**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**6.2**	**2.52**
8/3/2022	**715**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**3.9**	**1.56**
8/3/2022	**716**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**4.14**	**1.15**
8/3/2022	**717**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**5.23**	**1.92**

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Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	**718**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**4.96**	**1.76**
8/3/2022	**719**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**5.56**	**1.82**
8/3/2022	720	Basement By Back St	Wall	Brick	Green	Intact	Inconclusive	<LOD	1.47
8/3/2022	721	Basement By Back St	Wall	Brick	Green	Intact	Negative	<LOD	0.16
8/3/2022	722	Basement By Back St	Wall	Brick	Green	Intact	Negative	<LOD	0.51
8/3/2022	723	Basement By Back St	Wall	Brick	Green	Intact	Inconclusive	<LOD	1.15
8/3/2022	724	Basement By Back St	Wall	Brick	Green	Intact	Inconclusive	<LOD	2.28
8/3/2022	725	Basement By Back St	Wall	Brick	Green	Intact	Negative	<LOD	0.82
8/3/2022	726	Basement By Back St	Wall	Brick	Green	Intact	Inconclusive	<LOD	2.09
8/3/2022	727	Basement By Back St	Wall	Brick	Green	Intact	Inconclusive	<LOD	1.2
8/3/2022	**728**	**Basement By Back St**	**Wall**	**Brick**	**Green**	**Poor**	**Positive**	**4.31**	**1.58**
8/3/2022	729	Basement By Back St	Wall	Brick	Green	Intact	Negative	0.57	0.21
8/3/2022	730	Basement By Back St	Wall	Brick	White	Intact	Negative	<LOD	0.49
8/3/2022	**731**	**Basement By Back St**	**Wall**	**Brick**	**White**	**Fair**	**Positive**	**4.26**	**1.59**
8/3/2022	**732**	**Basement By Back St**	**Wall**	**Brick**	**White**	**Fair**	**Positive**	**2.05**	**0.52**
8/3/2022	733	Basement By Back St	Wall	Brick	White	Intact	Negative	<LOD	0.16
8/3/2022	734	Basement By Back St	Wall	Brick	White	Intact	Negative	0.05	0.02
8/3/2022	**735**	**Basement By Back St**	**Wall**	**Brick**	**White**	**Fair**	**Positive**	**2.6**	**0.92**
8/3/2022	**736**	**Basement By Back St**	**Wall**	**Brick**	**White**	**Fair**	**Positive**	**4.02**	**1.21**
8/3/2022	737	Basement By Back St	Wall	Brick	White	Intact	Inconclusive	<LOD	1.67
8/3/2022	738	Basement By Back St	Wall	Brick	White	Intact	Negative	<LOD	0.33
8/3/2022	739	Basement By Back St	Wall	Brick	White	Intact	Negative	<LOD	0.51
8/3/2022	**740**	**Basement By Back St**	**Wall**	**Brick**	**White**	**Fair**	**Positive**	**2.89**	**0.85**
8/3/2022	741	Basement By Back St	Wall	Brick	White	Intact	Inconclusive	<LOD	1.59
8/3/2022	742	Basement By Back St	Wall	Brick	White	Intact	Inconclusive	<LOD	1.01
8/3/2022	743	Basement By Back St	Wall	Brick	White	Intact	Negative	<LOD	0.44
8/3/2022	744	Basement By Back St	Wall	Brick	White	Intact	Negative	0.07	0.01
8/3/2022	745	Basement By Back St	Wall	Brick	White	Intact	Inconclusive	<LOD	1.41

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8/3/2022	746	Basement By Back St	Wall	Brick	White	Intact	Negative	<LOD	0.57
8/3/2022	747	Basement By Back St	Wall	Brick	White	Intact	Inconclusive	1.1	0.14
8/3/2022	**748**	**Basement By Back St**	**Wall**	**Brick**	**Yellow**	**Fair**	**Positive**	**2.95**	**1.27**
8/3/2022	749	Basement By Back St	Wall	Concrete	Beige	Intact	Negative	0.33	0.13
8/3/2022	750	Basement By Back St	Wall	Concrete	Beige	Intact	Negative	0.42	0.18
8/3/2022	751	Basement By Back St	Window Frame	Wood	Green	Intact	Negative	0.51	0.32
8/3/2022	752	Basement By Back St	Window Frame	Wood	Green	Intact	Inconclusive	0.69	0.23
8/3/2022	753	Basement By Back St	Window Frame	Wood	Green	Intact	Inconclusive	0.87	0.1
8/3/2022	754	Basement By Back St	Window Frame	Wood	Green	Intact	Inconclusive	0.77	0.17
8/3/2022	755	Basement By Back St	Window Frame	Wood	Green	Intact	Inconclusive	1.49	0.61
8/3/2022	756	Basement By Back St	Window Sill	Wood	Green	Intact	Negative	<LOD	0.14
8/3/2022	757	Basement By Back St	Column	Wood	Green	Intact	Negative	<LOD	0.04
8/3/2022	758	Basement By Back St	Door	Wood	Green	Intact	Negative	<LOD	0.06
8/3/2022	759	Basement By Back St	Door	Wood	Green	Intact	Negative	<LOD	0.02
8/3/2022	760	Basement By Back St	Door Frame	Wood	Green	Intact	Negative	<LOD	0.11
8/3/2022	**761**	**Basement By Back St**	**Door Jamb**	**Wood**	**White**	**Fair**	**Positive**	**5.19**	**1.55**
8/3/2022	**762**	**Basement By Back St**	**Door Jamb**	**Wood**	**White**	**Fair**	**Positive**	**10.62**	**3.72**
8/3/2022	**763**	**Basement By Back St**	**Door Jamb**	**Wood**	**White**	**Fair**	**Positive**	**5.41**	**1.88**
8/3/2022	764	Basement By Back St	Door Jamb	Wood	White	Intact	Negative	<LOD	0.02
8/3/2022	**765**	**Basement By Back St**	**Door Jamb**	**Wood**	**White**	**Fair**	**Positive**	**4.77**	**1.82**
8/3/2022	**766**	**Basement By Back St**	**Stringer**	**Wood**	**Gray**	**Fair**	**Positive**	**6.3**	**2.79**
8/3/2022	**767**	**Basement By Back St**	**Stringer**	**Wood**	**Gray**	**Fair**	**Positive**	**7.77**	**2.24**
8/3/2022	768	Basement By Back St	Stringer	Wood	Gray	Intact	Inconclusive	<LOD	1.29
8/3/2022	**769**	**Basement By Back St**	**Stringer**	**Metal**	**Gray**	**Fair**	**Positive**	**4.13**	**1.06**
8/3/2022	770	Basement By Back St	Railing	Metal	Gray	Intact	Inconclusive	<LOD	0.66
8/3/2022	771	Basement By Back St	Railing	Metal	Gray	Intact	Inconclusive	<LOD	1
8/3/2022	772	Basement By Back St	Railing	Metal	Gray	Intact	Inconclusive	<LOD	1.58
8/3/2022	773	Basement By Back St	Railing	Metal	Gray	Intact	Inconclusive	<LOD	0.89

<LOD = Less than the Level of Detection (not LBP)

MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	774	Basement By Back St	Railing	Metal	Gray	Intact	Negative	<LOD	0.39
8/3/2022	775	Basement By Back St	Railing	Metal	Gray	Intact	Inconclusive	<LOD	2.53
8/3/2022	**776**	**Basement By Back St**	**Railing**	**Metal**	**Gray**	**Intact**	**Positive**	**4.75**	**1.65**
8/3/2022	777	Basement By Back St	Railing	Metal	Gray	Intact	Negative	<LOD	0.14
8/3/2022	**778**	**Basement By Back St**	**Railing**	**Metal**	**Gray**	**Intact**	**Positive**	**2.49**	**0.65**
8/3/2022	779	Calibration			Red	Intact	Inconclusive	1.13	0.1
8/3/2022	780	Calibration			Red	Intact	Positive	1.2	0.1
8/3/2022	781	Calibration			Red	Intact	Inconclusive	1.13	0.1

<LOD = Less than the Level of Detection (not LBP)

TABLE 3

Paint Chip Sample Results

MONTROSE ENVIRONMENTAL

Table 3
Paint Chip Sample Results
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Sample ID	Date	Location, Color / Description	Lead Chip Concentration Indicative of Lead Hazard (% by weight)	Chip Sample Result (% by weight)
GISL-1	7/28/2022	3rd FL Hall Beige Window Sills	0.500%	0.012%
GISL-2	7/28/2022	3rd FL Hall Gray Baseboard	0.500%	<0.0080%
GISL-3	7/28/2022	Room 310 Beige Wall	0.500%	0.010%
GISL-4	7/28/2022	North Stairwell Beige Wall	0.500%	0.23%
GISL-5	7/28/2022	Room 305 Beige Wall	0.500%	0.19%
GISL-6	7/28/2022	Room 306 Beige Bay Window	0.500%	0.048%
GISL-7	**7/28/2022**	**Room 304 Beige Window**	**0.500%**	**1.50%**
GISL-8	7/28/2022	Room 303 Beige Window Sill	0.500%	0.47%
GISL-9	7/29/2022	Room 217 Beige Wall	0.500%	0.29%
GISL-10	7/29/2022	Room 219 Beige Wood Trim	0.500%	0.078%
GISL-11	7/29/2022	2nd FL North Hall Beige Wall	0.500%	<0.0080%
GISL-12	7/29/2022	Room 215 Aqua Door	0.500%	0.110%
GISL-13	7/29/2022	North Hall Stairwell Beige Wall	0.500%	<0.0080%
GISL-14	7/29/2022	Room 200 Beige Window Sill	0.500%	0.094%
GISL-15	**7/29/2022**	**Exterior Door #01 White**	**0.500%**	**16.00%**
GISL-16	7/28/2022	Room 116 Hall Beige Wall	0.500%	<0.0080%
GISL-17	8/2/2022	Library Room 112 Beige Wall	0.500%	0.21%
GISL-18	8/2/2022	Hallway by Room 112 Mustard Beige Wall	0.500%	<0.0080%
GISL-19	8/2/2022	Room 109 Beige Wall	0.500%	<0.0080%
GISL-20	8/2/2022	Room 110-3 Beige Ceiling	0.500%	0.49%
GISL-21	8/2/2022	Staff Dining Room 105 Beige Wall	0.500%	0.074%
GISL-22	8/2/2022	Cafeteria Room 104 Beige Wall	0.500%	0.10%
GISL-23	8/2/2022	Hallway by Room 103 Gray Floor	0.500%	0.015%

Table 3
Paint Chip Sample Results
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Sample ID	Date	Location, Color / Description	Lead Chip Concentration Indicative of Lead Hazard (% by weight)	Chip Sample Result (% by weight)
GISL-24	8/2/2022	Hallway by Room 106 Beige Wall	0.500%	0.34%
GISL-25	8/2/2022	Kitchen White Wall	0.500%	0.21%
GISL-26	8/2/2022	Hallway by Room 100	0.500%	0.35%
GISL-27	8/2/2022	Basement by Back-Street Gray Floor	0.500%	0.19%
GISL-28	8/2/2022	Basement by Back-Street Green Wall	0.500%	<0.0080%
GISL-29	8/2/2022	Basement by Back-Street Hallway White Wall	0.500%	0.31%
GISL-30	8/2/2022	Basement by Back-Street Gray Baseboard	0.500%	0.20%
GISL-31	**8/2/2022**	**Basement by Street White Door**	**0.500%**	**1.20%**
GISL-32	**8/2/2022**	**Basement by Street Red Door**	**0.500%**	**2.10%**

0.50% = Exceeds lead in paint concentration by weight

Appendix A

Licenses and Certifications

60111

NAETI Inc.

CERTIFICATE OF COMPLETION

This is to certify that

Julian Fernandez-Obregon

Successfully completed the course entitled

1-Day New Jersey/Lead Inspector/Risk Assessor Refresher on July 26th, 2021

Examination Passed on July 26th, 2021 *Expiration Date July 26th, 2023*

Lee Wasserman
President, NAETI Inc.

Language: English | 3 CE Units | ABIH 1 CM POINT

3321 Doris Avenue, Building B, Ocean, NJ 07712 **Phone (732) 531-5571** **Fax (732) 531-5956** **www.naeti.com**

59810

True Copy BM

NAETI Inc.

CERTIFICATE OF COMPLETION

AHERA/EPA Accredited Per 40 CFR Part 763
Asbestos Accreditation under TSCA Title II

Julian Fernandez-Obregon

Successfully completed the course entitled

1/2-Day New York State/EPA/AHERA Asbestos Building Inspector Annual Refresher on October 4th, 2021

Examination Passed on October 4th, 2021

Expiration Date on October 4th, 2022

Lee Wasserman
President, NAETI Inc.

Per 10 NYCRR Part 73.2 (L) (1). DOH 2832 Certificate of Completion of Asbestos Safety Training is the only official record of training for N.Y.S. students.

Language: English

ABIH 1/2 CM POINT

3321 Doris Avenue, Building B, Ocean, NJ 07712 **Phone (732) 531-5571** **Fax (732) 531-5956** **www.naeti.com**

Lead Identification Permit

New Jersey Department of Health

JULIAN M FERNANDEZ-OBREGON

Permit No.: 037807

ID No.: 026991

Expires: 8/28/2023

Authorization Signature:

Christina Tan, MD, M.P.H., Assistant Commissioner

Inspector/Risk Assessor

62313

NAETI Inc.

CERTIFICATE OF COMPLETION

AHERA/EPA Accredited Per 40 CFR Part 763
Asbestos Accreditation under TSCA Title II

This is to certify that

Collin Oriente

Successfully completed the course entitled

3-Day New York State/EPA/AHERA Asbestos Building Inspector Program on June 1st -3rd, 2022

Examination passed on June 3rd, 2022

Expiration Date on June 3rd, 2023

Steve Leon

Training Director , NAETI Inc.

Per 10 NYCRR Part 73.2 (L) (1), DOH 2832 Certificate of Completion of Asbestos Safety Training is the only official record of training for N.Y.S. students.

Language: English

ABIH 3 CM POINTS

3321 Doris Avenue, Building B, Ocean, NJ 07712 Phone (732) 531-5571 Fax (732) 531-5956 www.naeti.com

Name: MARISSA P WEINSTEIN

ID Number: 038032

P THESE INSTRUCTIONS FOR YOUR RECORDS. Please verify the
must have your permit at the job site and readily available for inspection by

partment of Health
d Occupational Health
ox 372
08625-0372
26-4950

This PERMIT has been issued in accordance with N.J.A.C. 8:62. You MUST have this PERMIT with you any time you are performing work for which it is required. Failure to carry this PERMIT or altering or falsifying this PERMIT may result in a civil administrative PENALTY of up to $1,000 per day for the first offense and up to $5,000/day for each subsequent offense. Each day shall constitute an additional and separate offense.

To report a lost or stolen PERMIT, defects to a PERMIT, or to find out how to renew a PERMIT, contact the NJ DOH (see below).

E-mail: iep.program@doh.nj.gov Telephone: 609-826-4950
Web: www.state.nj.us/health/eohap Fax: 609-826-4975
Address: NJ DOH, CEOHS, EOHAP
PO Box 372, Trenton, NJ 08625-0372

If this PERMIT is found abandoned, please send to the above address.

Issued By	*Card Number*	*Issue Date*
JF	**038032-1**	***4/28/2022***

E INSTRUCTIONS FOR YOUR RECORDS. Please verify the
e your permit

Co
Ex
Permit

Lead Identification Permit

New Jersey Department of Health

MARISSA P WEINSTEIN

Permit No.: 038032

ID No.: 038032

Expires: 4/28/2024

Authorization Signature: Christina Tan

Christina Tan, MD, M.P.H., Assistant Commissioner

Inspector/Risk Assessor

62037

NAETI Inc.

True Copy
BM

CERTIFICATE OF COMPLETION

AHERA/EPA Accredited Per 40 CFR Part 763
Asbestos Accreditation under TSCA Title II

Marissa Weinstein

Successfully completed the course entitled

1/2-Day EPA/AHERA Asbestos Building Inspector Annual Refresher on April 4th, 2022

Expiration Date on April 4th, 2023

Steve Leon
Training Director, NAETI Inc.

Per 10 NYCRR Part 73.2 (L) (1), DOH 2832 Certificate of Completion of Asbestos Safety Training is the only official record of training for N.Y.S. students.

Language: English

ABIH 1/2 CM POINT

3321 Doris Avenue, Building B, Ocean, NJ 07712 **Phone (732) 531-5571** **Fax (732) 531-5956** **www.naeti.com**

61553

NAETI Inc.

True Copy BM

CERTIFICATE OF COMPLETION

This is to certify that

Marissa Weinstein

Successfully completed the course entitled

5-Day New Jersey Lead Inspector/Risk Assessor Program on February 21st -25th, 2022

Examination Passed on February 25th, 2022 *Expiration Date on February 25th, 2024*

Steve Leon
Training Director, NAETI Inc.

Language: English ABIH 5 CM POINTS

3321 Doris Avenue, Building B, Ocean, NJ 07712 **Phone (732) 531-5571** **Fax (732) 531-5956** **www.naeti.com**

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 101048-0

EMSL Analytical, Inc.

Cinnaminson, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Asbestos Fiber Analysis

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2022-07-01 through 2023-06-30

Effective Dates

For the National Voluntary Laboratory Accreditation Program

National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Ms. Samantha Rundstrom
Phone: 856-303-2577
Email: srundstrom@emsl.com
http://www.emsl.com

ASBESTOS FIBER ANALYSIS **NVLAP LAB CODE 101048-0**

Bulk Asbestos Analysis

Code	*Description*
18/A01	EPA -- 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples
18/A03	EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials

Airborne Asbestos Analysis

Code	*Description*
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

For the National Voluntary Laboratory Accreditation Program

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

EMSL Analytical, Inc.

200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: 100194

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC accreditation to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories* in the following:

LABORATORY ACCREDITATION PROGRAMS

✓	**INDUSTRIAL HYGIENE**	Accreditation Expires: November 01, 2020
✓	**ENVIRONMENTAL LEAD**	Accreditation Expires: November 01, 2020
✓	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: November 01, 2020
☐	**FOOD**	Accreditation Expires:
☐	**UNIQUE SCOPES**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation**. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2005 and AIHA-LAP, LLC requirements. This certificate is not valid without the attached **Scope of Accreditation**. Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

Beth Bair

Elizabeth Bair
Chairperson, Analytical Accreditation Board

Cheryl O. Morton

Cheryl O. Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision 17 – 09/11/2018

Date Issued: 11/30/2018

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: **100194**
Issue Date: 11/30/2018

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

The EPA recognizes the AIHA-LAP, LLC ELLAP program as meeting the requirements of the National Lead Laboratory Accreditation Program (NLLAP) established under Title X of the Residential Lead-Based Paint Hazard Reduction Act of 1992 and includes paint, soil and dust wipe analysis. Air and composited wipes analyses are not included as part of the NLLAP.

Environmental Lead Laboratory Accreditation Program (ELLAP)

Initial Accreditation Date: 01/18/1995

Field of Testing (FoT)	Technology sub-type/ Detector	Method	Method Description (*for internal methods only*)
Paint		EPA SW-846 3050B	
		EPA SW-846 7000B	
Soil		EPA SW-846 3050B	
		EPA SW-846 7000B	
Settled Dust by Wipe		EPA SW-846 3050B	
		EPA SW-846 7000B	
Airborne Dust		NIOSH 7082	
Composited Wipes		EPA SW-846 3050B	
		EPA SW-846 7000B	

A complete listing of currently accredited Environmental Lead laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077

Laboratory ID: LAP-100194

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC accreditation to the ISO/IEC 17025:2017 international standard, General Requirements for the Competence of Testing and Calibration Laboratories in the following:

LABORATORY ACCREDITATION PROGRAMS

☑	**INDUSTRIAL HYGIENE**	Accreditation Expires: November 01, 2022
☑	**ENVIRONMENTAL LEAD**	Accreditation Expires: November 01, 2022
☑	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: November 01, 2022
☐	**FOOD**	Accreditation Expires:
☐	**UNIQUE SCOPES**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached Scope of Accreditation. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2017 and AIHA-LAP, LLC requirements. This certificate is not valid without the attached Scope of Accreditation. Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

Cheryl O. Morton

Cheryl O Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision19: 09/01/2020

Date Issued: 10/31/2020

AIHA Laboratory Accreditation Programs, LLC

SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077

Laboratory ID: LAP-100194
Issue Date: 10/31/2020

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 02/01/1989

IHLAP Scope Category	Field of Testing (FOT)	Technology sub-type/Detector	Published Reference Method/Title of In-house Method	Component, parameter or characteristic tested
Asbestos/Fiber Microscopy Core	Phase Contrast Microscopy (PCM)	-	NIOSH 7400	Asbestos/Fibers
Asbestos/Fiber Microscopy Core	Polarized Light Microscopy (PLM)	-	EPA 600/R-93/116	Asbestos & Other Fibers in Bulk
Asbestos/Fiber Microscopy Core	Transmission Electron Microscopy (TEM)	-	EPA AHERA - 40 CFR Part 763	Asbestos
Asbestos/Fiber Microscopy Core	Transmission Electron Microscopy (TEM)	-	NIOSH 7402	Asbestos/Fibers
Beryllium Testing	Inductively-Coupled Plasma	ICP/AES	NIOSH 7303 Modified	Beryllium
Beryllium Testing	Inductively-Coupled Plasma	ICP/MS	NIOSH 7300 Modified	Beryllium
Chromatography Core	GC/MS	-	EPA TO-15	Volatile Organic Compounds
Chromatography Core	Gas Chromatography	GC/ECD	NIOSH 5502 Modified	Aldrin & Lindane
Chromatography Core	Gas Chromatography	GC/ECD	NIOSH 5503 Modified	Polychlorinated biphenyls
Chromatography Core	Gas Chromatography	GC/ECD	NIOSH 5510 Modified	Chlordane
Chromatography Core	Gas Chromatography	GC/ECD	OSHA 1010 Modified	Ethylene Oxide
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1003 Modified	Halogenated Hydrocarbons
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1005 Modified	Methylene Chloride
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1400 Modified	Alcohols
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1500 Modified	Hydrocarbons
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1501 Modified	Aromatic Hydrocarbons
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1550 Modified	Total Petroleum Hydrocarbons

IHLAP Scope Category	Field of Testing (FOT)	Technology sub-type/Detector	Published Reference Method/Title of In-house Method	Component, parameter or characteristic tested
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1603 Modified	Acetic Acid
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 2000 Modified	Methyl Alcohol
Chromatography Core	Gas Chromatography (Diffusive Samplers)	-	NIOSH 1501	Aromatic Hydrocarbons
Chromatography Core	Ion Chromatography (IC)	-	NIOSH 6004 Modified	Sulfur Dioxide/Sulfate
Chromatography Core	Ion Chromatography (IC)	-	NIOSH 6011	Chlorine & Bromine
Chromatography Core	Ion Chromatography (IC)	-	NIOSH 7903	Inorganic Acids
Chromatography Core	Ion Chromatography (IC)	-	OSHA ID-214	Ozone
Chromatography Core	Ion Chromatography (IC)	-	OSHA ID-215 (Version 2) Modified	Hexavalent Chromium
Chromatography Core	Liquid Chromatography	HPLC/FL	NIOSH 2016	Formaldehyde
Chromatography Core	Liquid Chromatography	HPLC/UV	NIOSH 5506 Modified	Polynuclear Aromatic Hydrocarbons (PAHs)
Chromatography Core	Liquid Chromatography	LC/MS	NIOSH 9111 Modified	Methamphetamines
Miscellaneous Core	Gravimetric	-	NIOSH 0500	Total Dust
Miscellaneous Core	Gravimetric	-	NIOSH 0600	Respirable Dust
Miscellaneous Core	Gravimetric	-	NIOSH 5524	Metal Working Fluids
Miscellaneous Core	Thermo-optical Analysis (TOA)	-	NIOSH 5040	Elemental Carbon
Spectrometry Core	Atomic Absorption	CVAA	NIOSH 6009 Modified	Mercury
Spectrometry Core	Atomic Absorption	CVAA	OSHA ID-140 Modified	Mercury vapor
Spectrometry Core	Atomic Absorption	CVAA	OSHA ID-145	Mercury particulate
Spectrometry Core	Atomic Absorption	FAA	NIOSH 7082	Lead
Spectrometry Core	Atomic Absorption	GFAA	NIOSH 7105	Lead
Spectrometry Core	Inductively-Coupled Plasma	ICP/AES	NIOSH 7300 Modified	Lead
Spectrometry Core	Inductively-Coupled Plasma	ICP/MS	NIOSH 7300 Modified	Lead
Spectrometry Core	UV/VIS (Colorimetric)	-	NIOSH 6010	Hydrogen Cyanide
Spectrometry Core	X-ray Diffraction (XRD)	-	NIOSH 7500	Silica
Spectrometry Core	X-ray Diffraction (XRD)	-	OSHA ID-142	Silica

A complete listing of currently accredited IHLAP laboratories is available on the AIHA-LAP, LLC website at: *http://www.aihaaccreditedlabs.org*

Appendix B

Photo Log of Suspect and Confirmed ACM

Photo 1. S-03, S-04 White and Brown Plaster – 3rd Floor Bathroom

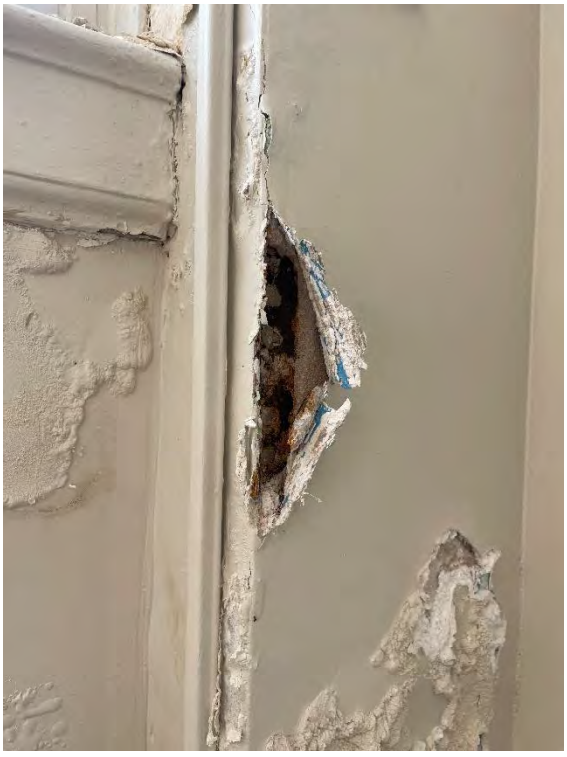

Photo 2. M-02 Plaster Joint Compound – 3rd Floor Bathroom

Photo 3. M-09 Gray with Specks 12x12" Floor Tile - 3rd Floor Rooms

Photo 4. M-12 Blue Baseboard and Mastic – 3rd Floor Rooms

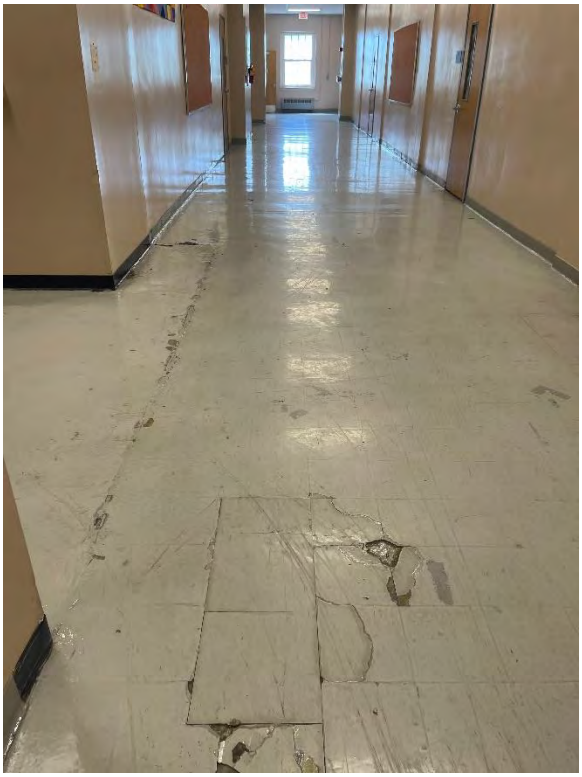

Photo 5. M-17 Brown/Tan 9x9'' Floor Tile – 3rd Floor Hallway

Photo 6. M-21 Drywall – Room 305

Photo 7. M-19, M-22 White and Dark Blue 12x12'' Floor Tile – Room 305

Photo 8. M-07 White and Green 12x12'' Floor Tile – Room 305

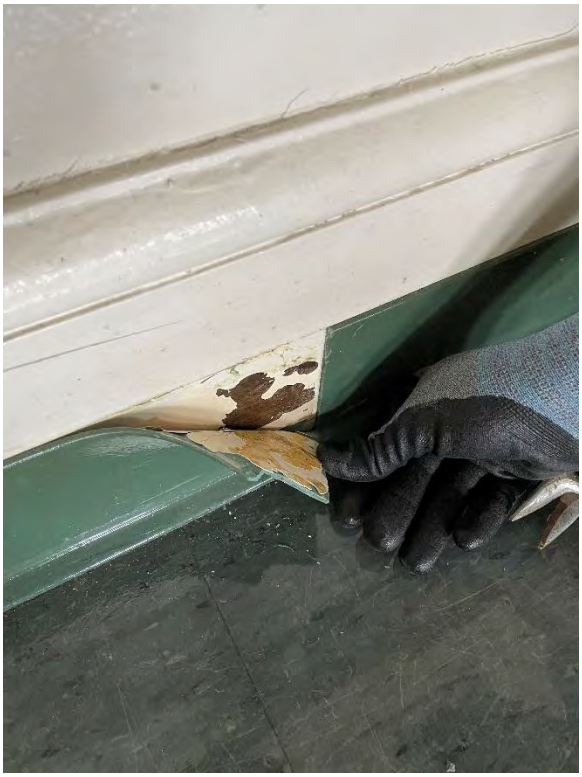

Photo 9. M-05 Green Baseboard and Mastic – 3rd Floor Rooms

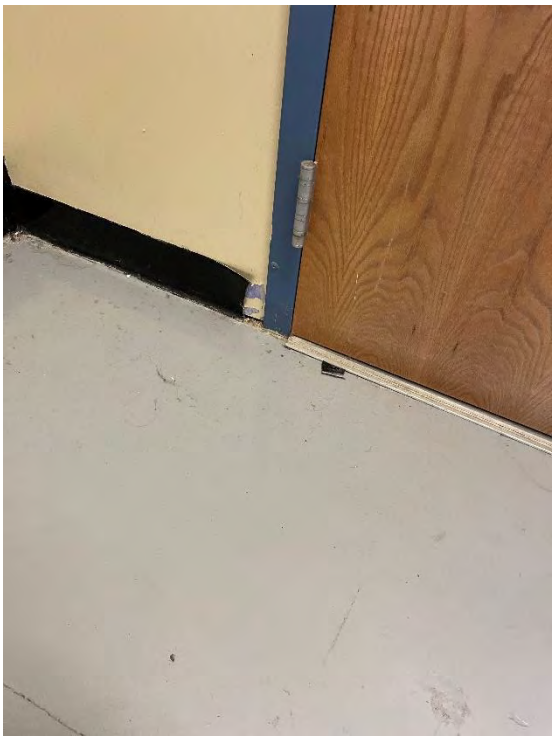

Photo 10. M-25 Black Baseboard and Mastic – 3rd Floor Stairway

Photo 11. M-27 Black Tar – Attic

Photo 12. M-28 Black Sheeting – Attic

Photo 13. M-29 White Caulk -- Attic

Photo 14. M-31 White Floor Tile with Grey Specks 12x12'' –Room 217

Photo 15. M-33 Blue Baseboard and Mastic – Room 217

Photo 16. M-34 Black Baseboard and Mastic –Room 219

Photo 17. M-35 Carpet Mastic – Room 219

Photo 18. M-36 Drywall Joint Compound – Room 219

Photo 19. M-37 Black Glue Tar – Steps Under Stairwell 2nd Floor

Photo 20. M-38 Drywall – Room 217

Photo 21. M-39 White 2x4' Pinhole Ceiling Tile – Hallway Outside 217

Photo 22. M-40 Dark Blue 12x12" Floor Tile – Outside of Elevator

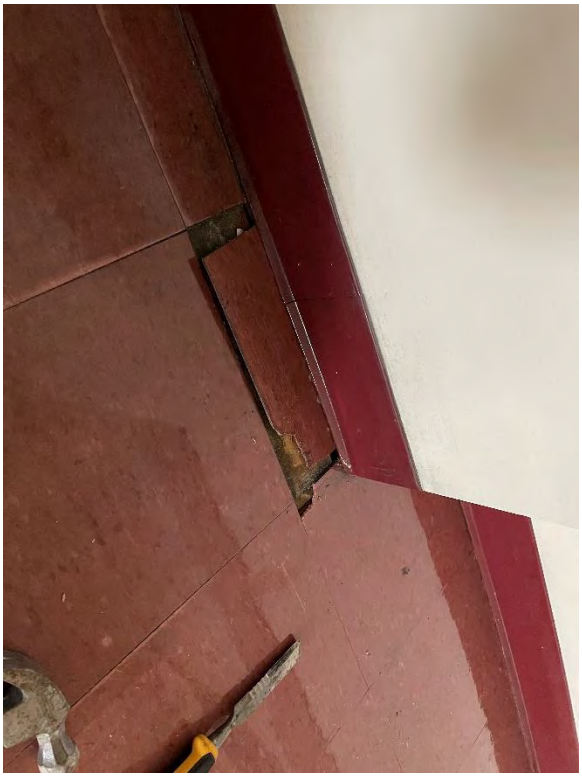

Photo 23. M-43 Red 12x12" Floor Tile – Room 212

Photo 24. M-45 Tan Speckled 12x12" Floor Tile – Room 212

Photo 25. S-47,48 White and Brown Plaster – Steps near stairwell

Photo 26. M-49 Light Blue 12x12" Floor Tile – Room 209/211

Photo 27. M-51 Red Baseboard and Mastic – Room 202

Photo 28. S-52, S-53 Plaster White and Brown – End of Hall South

Photo 29. M-54 Black Counters – Room 200

Photo 30. M-55 Linoleum Black Traction Tread – Hallway South

Photo 31. M-57 Pinhole and Circular Crater 2x4' White Ceiling Tile – Room 215

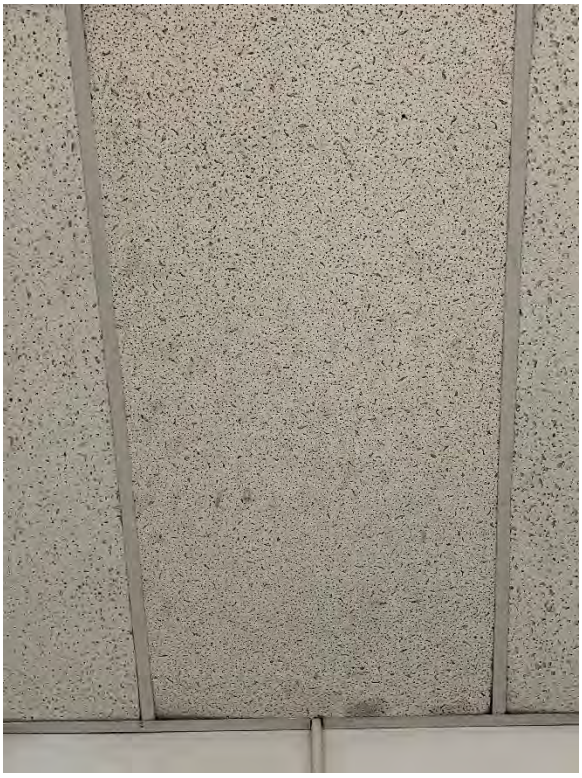

Photo 32. M-58 Pinhole and Oblong Crater 2x4' White Ceiling Tile – Room 215

Photo 33. M-59 Black Sink Undercoating – Room 217

Photo 34. M-62 White Floor Tile with Grey Specks 12x12'' – Room 202

Photo 35. M-64 Red 12x12'' Floor Tile – Room 201

Photo 36. M-66 Drywall – Room 201

Photo 37. M-68 Light Blue 12x12'' Floor Tile – Room 200

Photo 38. M-72, M-74 Dark Blue 12x12'' Floor Tile, White Floor Tile with Grey Specks 12x12''-- Outside Room 114

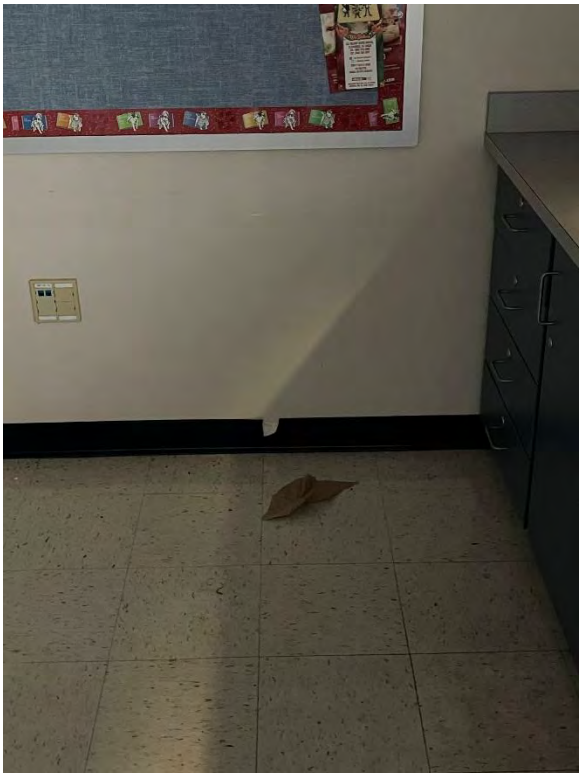

Photo 39. M-77 Blue Baseboard and Mastic – Library

Photo 40. M-78 Carpet Mastic – Library

Photo 41. S-79, S-80 White and Brown Plaster – Library

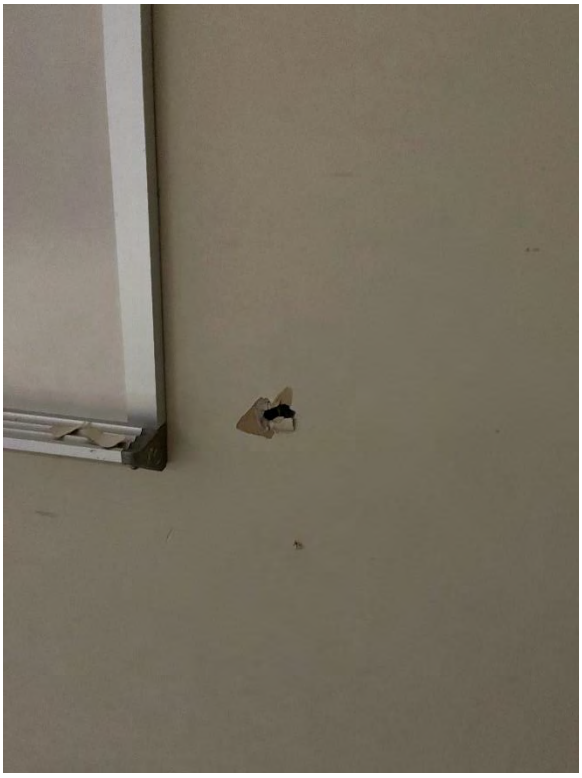

Photo 42. M-81 Drywall – Room 116

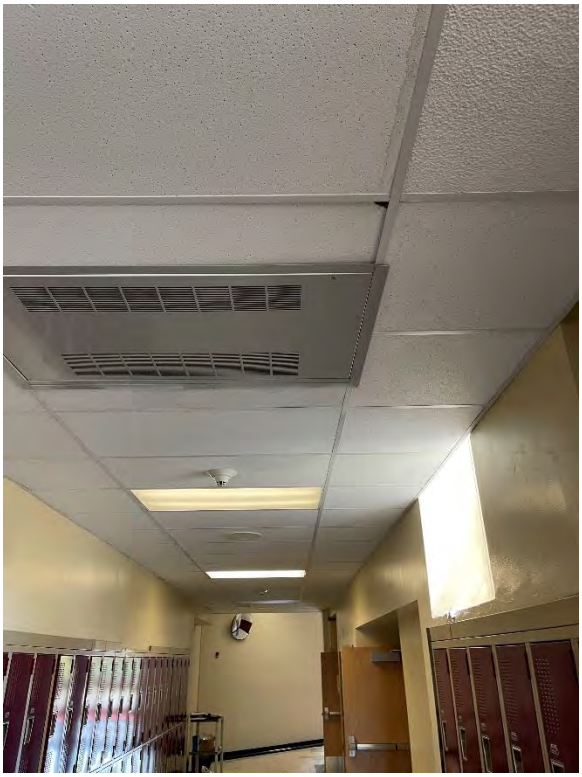

Photo 43. M-82 White Pinhole 2'x4' Ceiling Tile – Hallway Outside Library

Photo 44. M-83 Pinhole with Small Circular Crater White 2'x4' Ceiling Tile – Outside Room 114

Photo 45. M-84 Spray-On Insulation -- Inside Maintenance Closets Library Hallway

Photo 46. M-85 Black Window Ledge – Corridor Before Gym

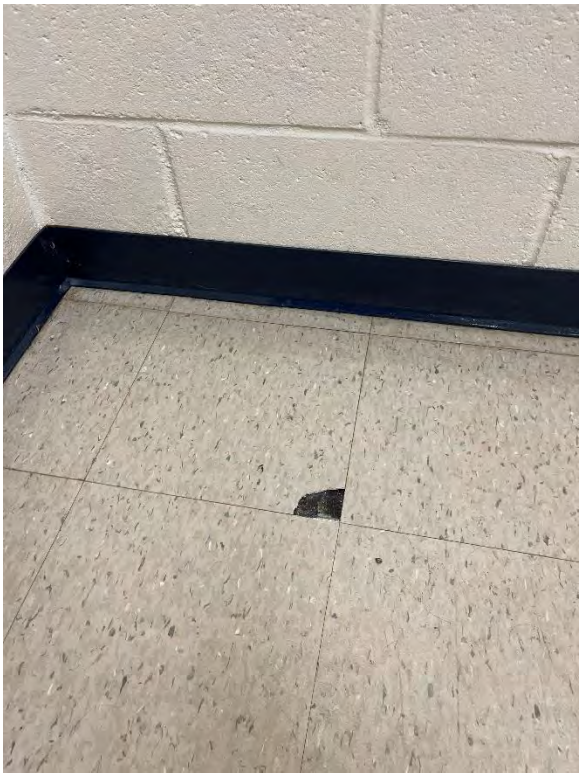

Photo 47. M-86 Tan Speckled 12x12'' Floor Tile -- Locker Room Offices

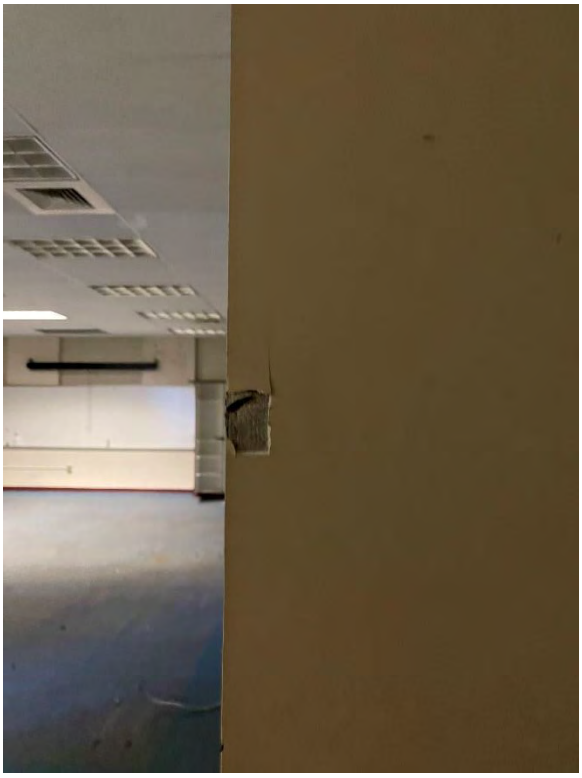

Photo 48. M-88 Joint Compound – Room 114

Photo 49. M-91 Red 12x12'' Floor Tile – Room 109

Photo 50. M-93 Red Baseboard and Mastic – Room 109

Photo 51. M-94 Dark Green with Colored Specks 12"x12" Floor Tile – Room 107

Photo 52. M-96 Green Baseboard – Room 107

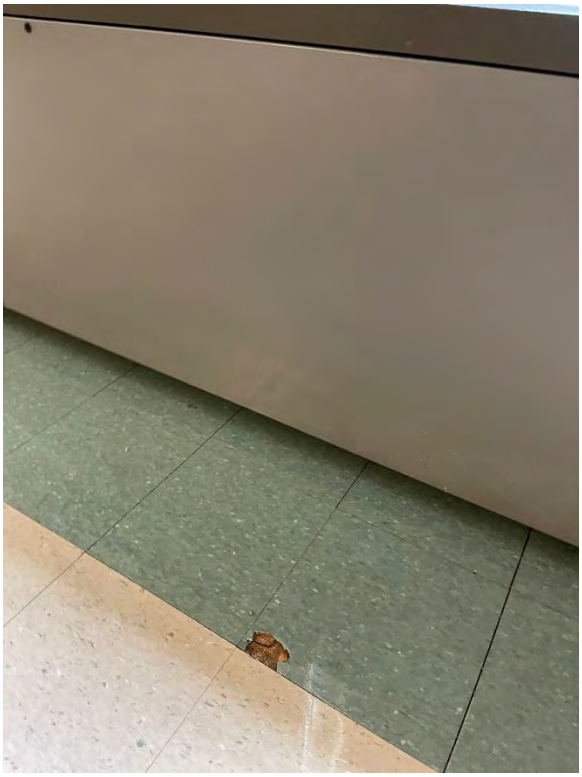

Photo 53. M-98 Light Green with Colored Specks 12"x12" Floor Tile – Staff Dining

Photo 54. M-100 Burgundy Baseboard – Main Office

Photo 55. M-101 Tan with Colored Specks 12x12'' Floor Tile– Staff Dining

Photo 56. M-104 Pinhole 2x4' White Ceiling Tile – North Stairwell

Photo 57. M-109, M-110 White and Brown Plaster – South Stairwell

Photo 58. M-111 Drywall – Main Office

Photo 59. M-112 12x12" Pink Floor Tile – Nurse

Photo 60. M-114 Black Sink Undercoating – Nurse

Photo 61. M-115 Light Green with White Specks 12x12" Floor Tile – Nurse

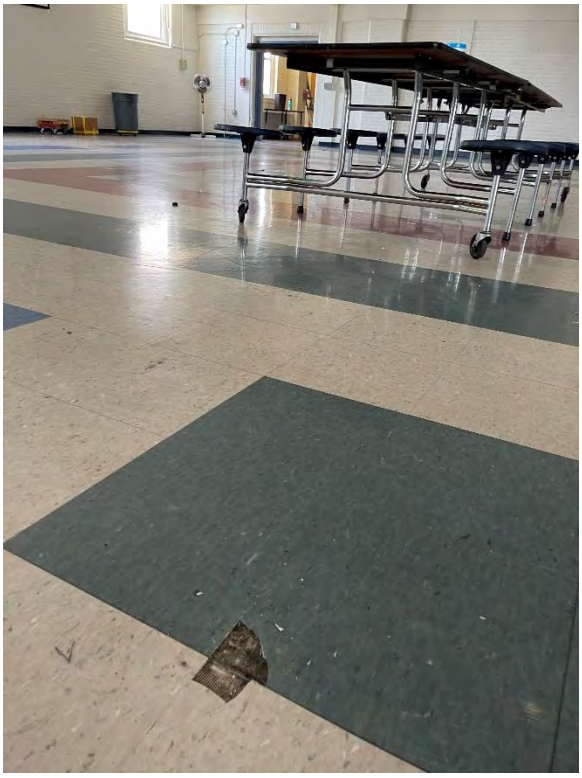

Photo 62. M-122, M-126 Beige Speckled and Green 12x12'' Floor Tile – Cafeteria

Photo 63. M-124 Red 12x12'' Floor Tile – Cafeteria

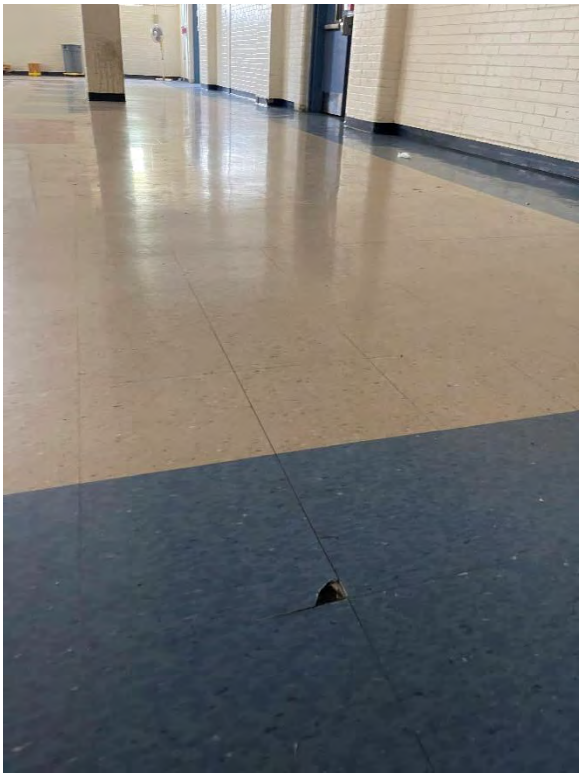

Photo 64. M-128 Blue 12x12" Floor Tile – Cafeteria

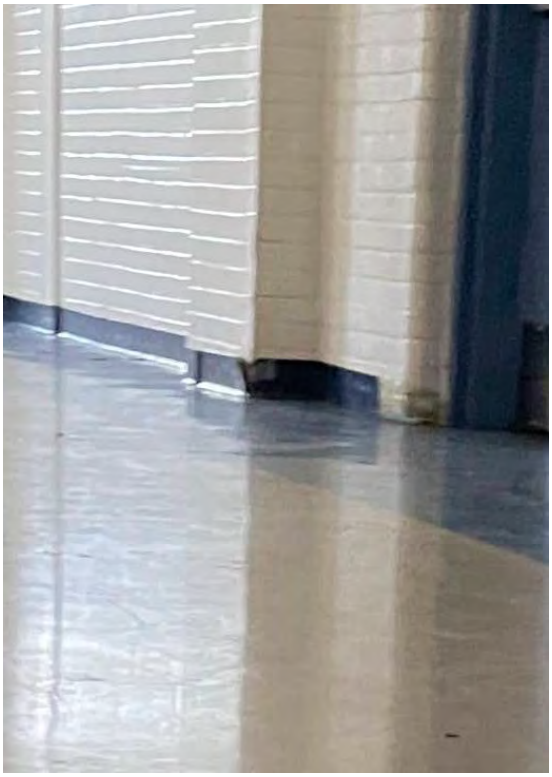

Photo 65. M-130 Blue Baseboard and Mastic – Cafeteria

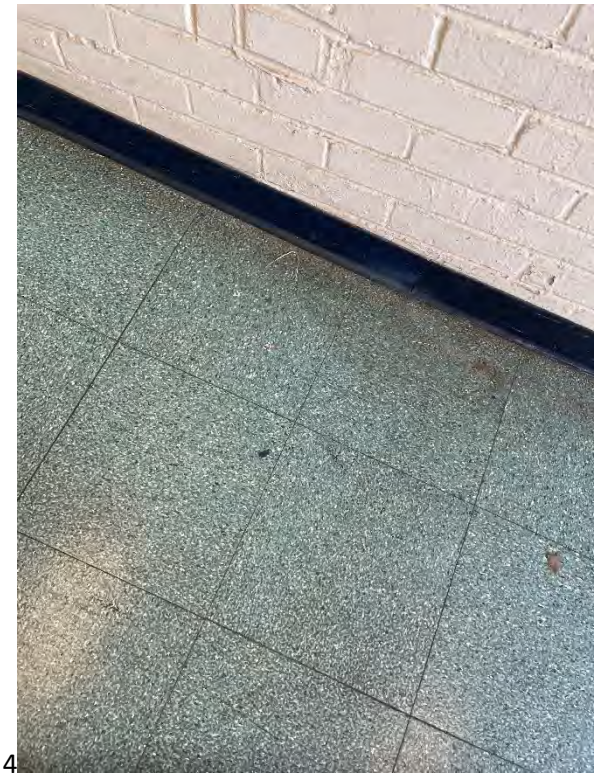

Photo 66. M-132 Teal 12x12" Linoleum Floor Tile – Back Entrance Ramp

Photo 67. M-136 White 2x2' Pinhole Ceiling Tile – Cafeteria Hallway

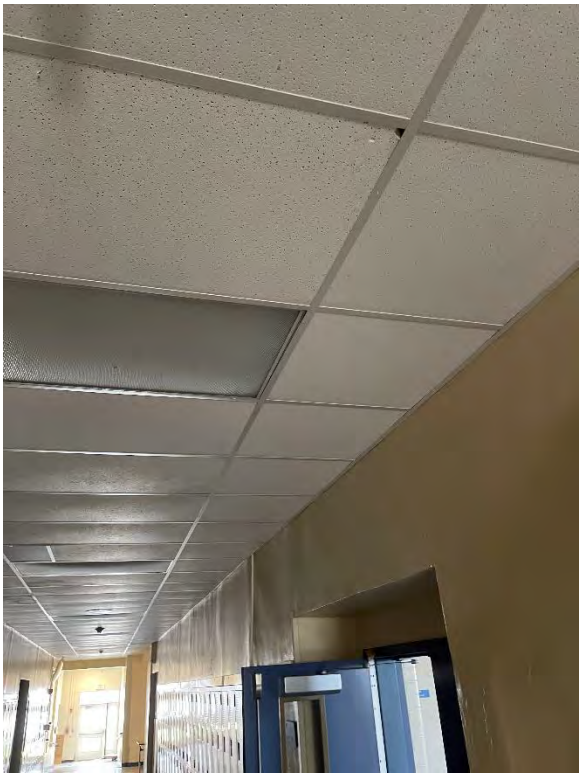

Photo 68. M-137 White 2x4' Pinhole Ceiling Tile– Cafeteria Hallway

Photo 69. M-138 Tan Carpet Mastic – Room 100

Photo 70. M-139 Gray Boiler Insulation – Basement by Street

Photo 71. M-141 Red Boiler Caulk – Basement by Street

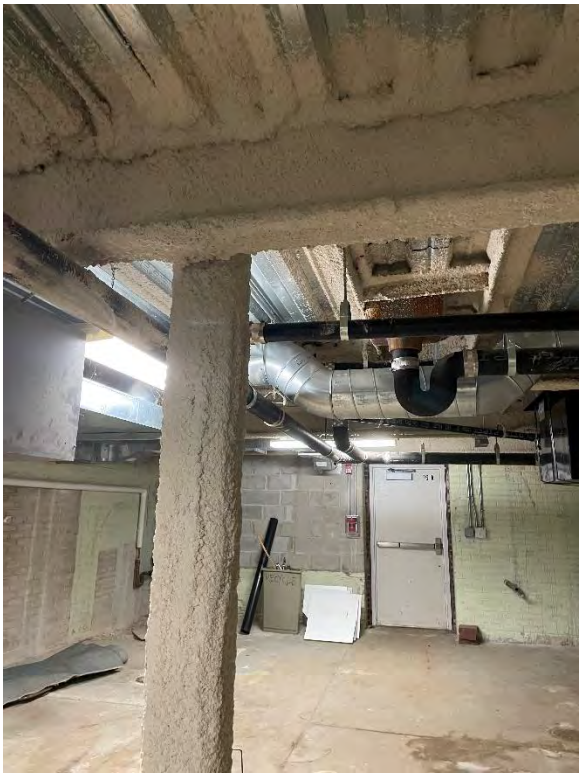

Photo 72. M-142 Gray Spray-On Insulation – Basement by Back Street

Photo 73. M-143 Brown 9x9'' Floor Tile – Basement First Room on Right

Photo 74. M-145 Fire Caulk – Emergency Fire Exit

Photo 75. M-146 Debris from Crawlspace – Crawl Space with Asbestos Hazard Sign

Highlighted Red = Confirmed ACM

Photo 1. M-01 Black Mats – Roof 1 Lower Right

Photo 2. M-02 Silver Roof Liner – Roof 1 Lower Right

Photo 3. M-03 Roof Core – Roof 1 Lower Right

Photo 4. M-03 Roof Core – Roof 1 Middle

Photo 5. M-04 HVAC Skirt – Roof 1 Lower Right

Photo 6. M-05 Tar – Roof 1 Middle Near Drain

Photo 7. M-06 Metal Coating on Pipe– Roof 1 Middle

Photo 8. M-07 Tar – Roof 1 Middle on Ledge

Photo 9. M-08 Copper Flashing and Mastic – Roof 1 Upper Left

Photo 10. M-10 Black Caulk – Roof 1 Lower Left

Photo 11. M-11 White Caulk – Roof 1 Lower Left

Photo 12. M-12 White Caulk – Roof 2 Lower Right

Photo 13. M-13 Black Caulk – Roof 2 Lower Right

Photo 14. M-14 Roof Core – Roof 2 Lower Right

Photo 15. M-14 Roof Core– Roof 2 Upper Right

Photo 16. M-14 Roof Core – Roof 2 Upper Left

Photo 15. M-16 Black Tar Sealant– Roof 2 Upper Left

Photo 16. M-17 Roof Core – Center Front Roof

Appendix C

Photo Log of Suspect and Confirmed LBP

Photo 1. Beige Archway and White Baseboards – Side Area/Stairs by Room 112

Photo 2. Beige Window Sill – Side Area/Stairs by Room 112

Photo 3. Beige Brick Walls – Walls B and C in Room 114

Photo 4. Beige Door Frame – Basement by Front Street

Photo 5. Red Door Frame – Basement by Front Street

Photo 6. White Door – Basement by Front Street

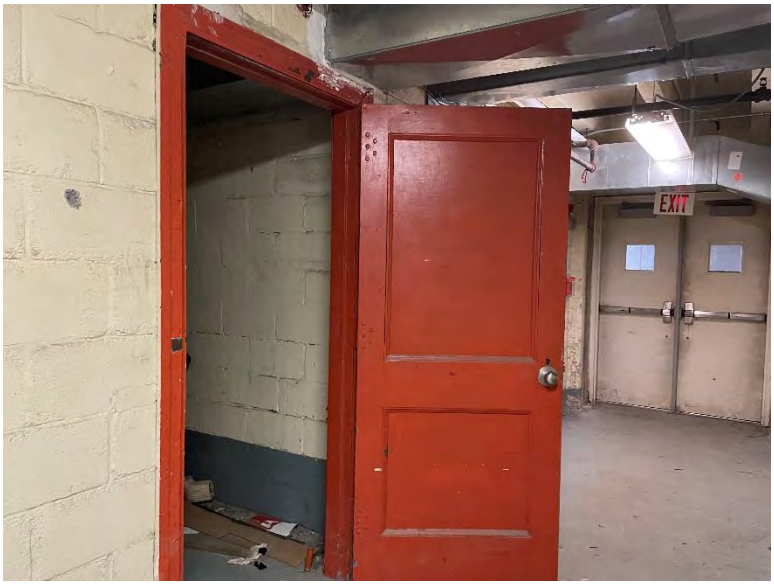

Photo 7. Red Metal Door and Frame – Basement by Front Street

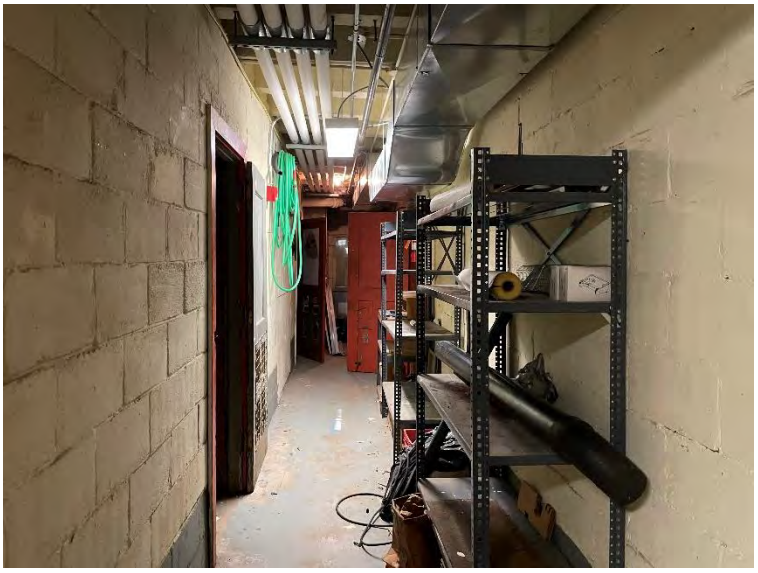

Photo 8. Beige Walls (B, C, D) – Basement by Front Street

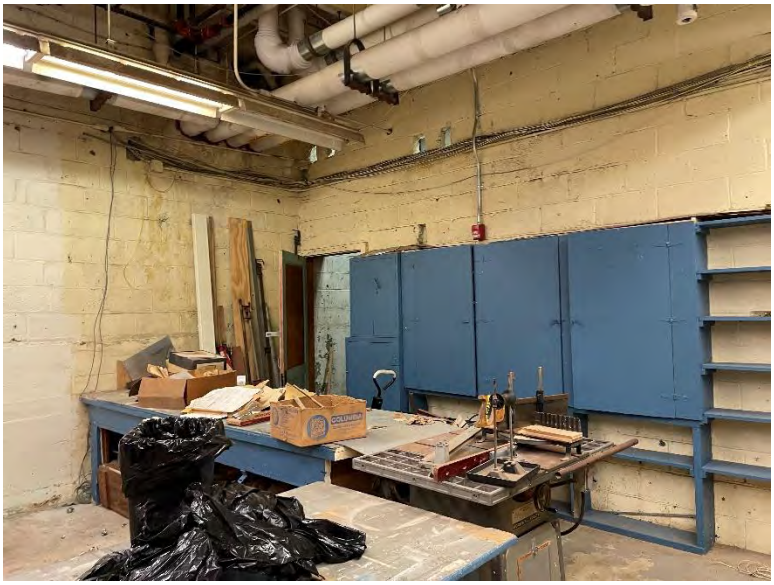

Photo 9. Tan Concrete Walls (A and B) – Room off of Basement by Front Street

Photo 10. White Door Frame – Room off of Basement by Front Street

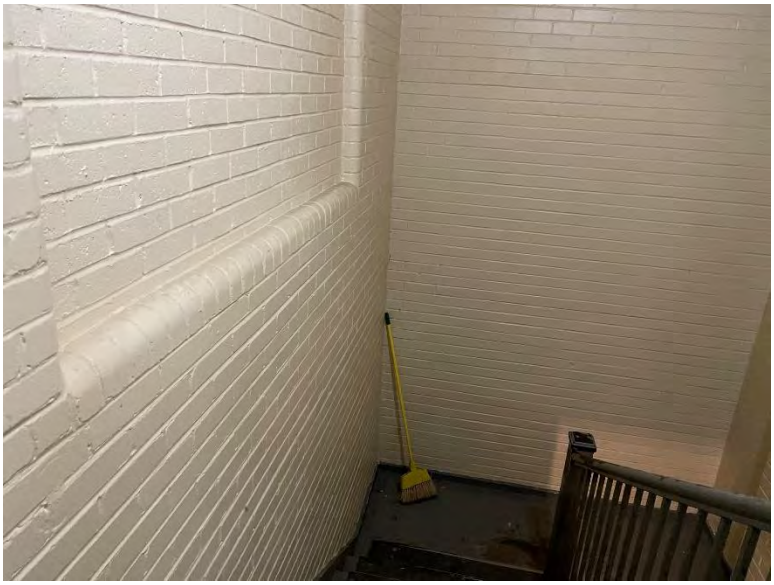

Photo 11. Beige Stairway (B) – Basement by Back Street

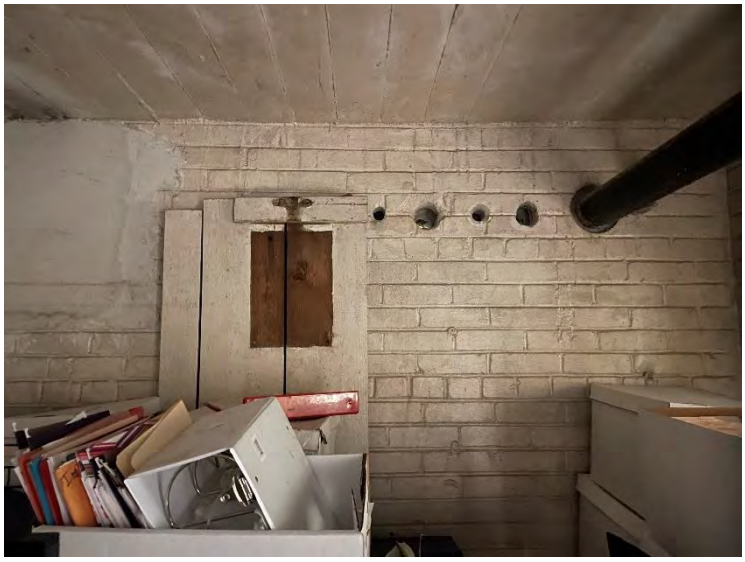

Photo 12. Beige Wall (B) – Room off of Basement by Back Street

Photo 13. Green Wall (B) -- Basement by Back Street

Photo 14. Green Wall Areas – Basement by Back Street

Photo 15. Yellow Lined Paint – Basement by Back Street

Photo 16. White Door Jamb – Basement by Back Street

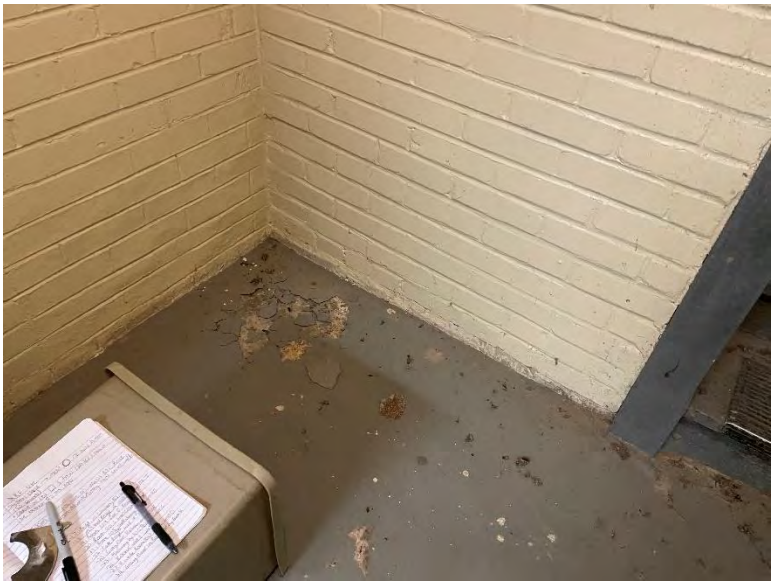

Photo 17. Gray Floor – Basement by Back Street

Photo 18. Differently Painted Area – Basement by Back Street

Photo 19. Gray Railing – Basement by Back Street

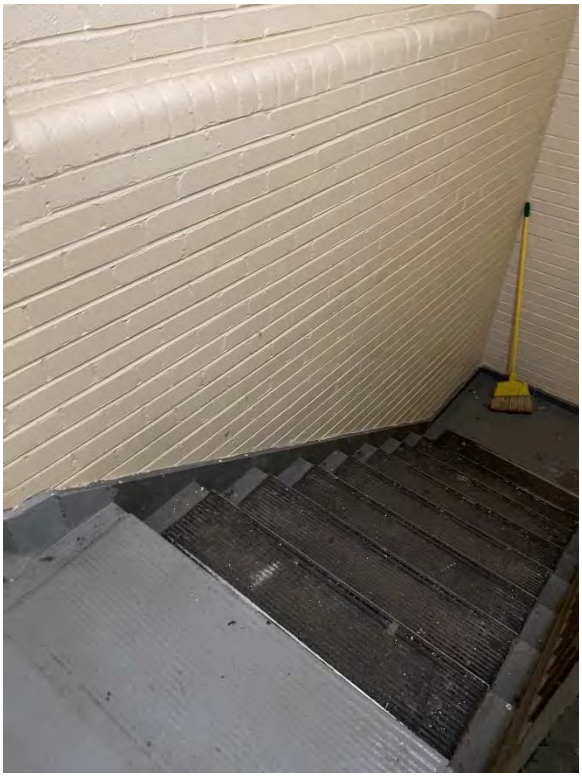

Photo 20. Beige Wall in Stairway – Basement by Back Street

Photo 21. Beige Stairway Walls – Basement by Front Street

Appendix D

Laboratory Reports

OrderID: 042218716

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Chain of Custody

EMSL Order Number *(Lab Use Only)*: 042218716

RECEIVED EMSL CINNAMINSON, NJ 22 AUG -1 PM 4:00

EMSL ANALYTICAL, INC.
200 ROUTE 130 N
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5973

Company : PARS Environmental

EMSL-Bill to: ☒ Same ☐ Different
If Bill to is Different note instructions in Comments**
Third Party Billing requires written authorization from third party

Street: 500 Horizon Drive, Suite 540

City: Robbinsville | **State/Province: NJ** | **Zip/Postal Code: 08691** | **Country: USA**

Report To (Name): Julian Fernandez-Obregon | **Fax #: 609-890-9116**

Telephone #: 609-890-7277 | **Email Address: jfernandez@montrose-env.com**

Project Name/Number: Glassboro Intermediate School

Please Provide Results: ☐ Fax ☒ Email | **Purchase Order: 1200-42** | **U.S. State Samples Taken: NJ**

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☒ 1 Week ☐ 2 Week

**For TEM Air 3 hr through 6 hr, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air
- ☐ NIOSH 7400
- ☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
- ☒ PLM EPA 600/R-93/116 (<1%)
- ☒ PLM EPA NOB (<1%)

Point Count
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)

Point Count w/Gravimetric
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- ☐ NYS 198.1 (friable in NY)
- ☐ NYS 198.6 NOB (non-friable-NY)
- ☐ NIOSH 9002 (<1%)

TEM – Air ☐ **4-4.5hr TAT (AHERA only)**
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312

TEM - Bulk
- ☒ TEM EPA NOB
- ☐ NYS NOB 198.4 (non-friable-NY)
- ☐ Chatfield SOP
- ☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2
- Fibers >10µm ☐ Waste ☐ Drinking
- All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
- ☐ Microvac - ASTM D 5755
- ☐ Wipe - ASTM D6480
- ☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
- ☐ PLM CARB 435 - A (0.25% sensitivity)
- ☐ PLM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - C (0.01% sensitivity)
- ☐ EPA Protocol (Semi-Quantitative)
- ☐ EPA Protocol (Quantitative)

Other:
- ☐

☐ **Check For Positive Stop – Clearly Identify Homogenous Group**

Samplers Name: Marissa Weinstein | **Samplers Signature:** Marissa Weinstein

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
	See Attached		

Client Sample # (s): - **Total # of Samples:** 210

Relinquished (Client): Marissa Weinstein **Date:** 8/1/2022 **Time:**

Received (Lab): David Stepp WT **Date:** 8-1-22 **Time:** 3:50 pm

Comments/Special Instructions:

210 MS

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 2

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-1	Pinhole Ceiling Tile	GIS-1 GIS-2 GIS-3	Third Floor Hallway	1600	D	
M-2	Plaster Joint compound	GIS-4 GIS-5 GIS-6	Third Floor Hallway	10	D	
S-3	White Plaster	GIS-7 GIS-9 GIS-11	Third Floor	5,000	D	
S-4	Brown Plaster	GIS-8 GIS-10 GIS-12	Third Floor	5,000	D	
M-5	Green Baseboard	GIS-13 GIS-15 GIS-17	Third Floor Rooms	750	D	
M-6	Mastic Associated w/ M-5	GIS-14 GIS-16 GIS-18	Third Floor Rooms	750	D	
M-7	Green w/ specks 12"x12" Floor Tile	GIS-19 GIS-21 GIS-23	Third Floor Rooms	1860	D	
M-8	Mastic Associated w/ M-7	GIS-20 GIS-24 GIS-22	Third Floor Rooms	1860	D	
M-9	Gray w/ specks 12"x12" Floor Tile	GIS-25 GIS-27 GIS-29	Third Floor Rooms	5,000	D	
M-10	Mastic Associated w/ M-9	GIS-26 GIS-28 GIS-30	Third Floor Rooms	5,000	D	

RECEIVED EMSL CINNAMINSON, NJ 22 AUG -1 PM 4:00

Signature: Marina West Date Sampled: 7/28/2022 PARS Project #: 1200-42

OrderID: 042218716

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 3

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
m-11	Patch Compound	GIS-31 GIS-32 GIS-33	Third Floor Room 310, North Stairs	5	D	
m-12	Blue Baseboard	GIS-34 GIS-36 GIS-38	Third Floor Rooms 307+308	750	D	
m-13	Mastic Associated w/ m-12	GIS-35 GIS-37 GIS-39	Third Floor Rooms 307+308	750	D	
m-14	Blue 12"x12" Floor w/ specks Tile	GIS-40 GIS-42 GIS-44	Third Floor Rooms 307+308	2,000	D	
m-15	Mastic Associated w/ m-14	GIS-41 GIS-43 GIS-45	Third Floor Rooms 307+308	2,000	D	
m-16	Burgandy Fire Caulk	GIS-46 GIS-47 GIS-48	Third Floor North Stairs	5	D	
m-17	Brown/Tan 9"x9" Floor Tile	GIS-49 GIS-51 GIS-53	Third Floor Hallway	720	D	
m-18	Mastic Associated w/ m-17	GIS-50 GIS-52 GIS-54	Third Floor Hallway	720	D	
m-19	Dark Blue 12"x12" Floor Tile	GIS-55 GIS-57 GIS-59	Third Floor Room 305	796	D	
m-20	Mastic Associated w/ m-19	GIS-56 GIS-58 GIS-60	Third Floor Room 305	796	D	

RECEIVED EMSL CINNAMINSON, NJ 22 AUG -1 PM 4:00

Signature: Marcus West Date Sampled: 7/28/2022 PARS Project #: 1200-42

OrderID: 042218716

042218716

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 4

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
m-21	Drywall	GIS-61 GIS-62 GIS-63	Third Floor Room 305	350	D	
m-22	white w/ Gray Spots 12"x12" Floor Tile	GIS-64 GIS-66 GIS-68	Third Floor Room 305	1580	D	
m-23	mastic Associated w/ m-22	GIS-65 GIS-67 GIS-69	Third Floor Room 305	1580	D	
m-24	Joint Compound	GIS-70 GIS-71 GIS-72	Third Floor	250	D	
m-25	Black Baseboard	GIS-73 GIS-75 GIS-77	Third Floor stairways	30	D	
m-26	mastic Associated w/ m-25	GIS-74 GIS-76 GIS-78	Third Floor stairways	30	D	
m-27	Black Tar	GIS-79 GIS-80 GIS-81	Attic	10	D	
m-28	Black Sheeting	GIS-82 GIS-83 GIS-84	Attic	100	D	
m-29	White caulk	GIS-85 GIS-86 GIS-87	Attic	100	D	
m-30	Gray Baseboard mastic	GIS-88 GIS-89 GIS-90	Third Floor Elevator Area	153	D	

RECEIVED
EMSL
CINNAMINSON, NJ
22 AUG -1 PM 4:00

Signature: Marin West Date Sampled: 7/28/2022 PARS Project #: 1200-42

OrderID: 042218716

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 5

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-31	White Floor tile with Grey specks 12x12 in	GIS-91 GIS-93 GIS-95	2nd floor Faculty Lounge	696 SF	D	
M-32	Mastic Associated with m-31	GIS-92 GIS-94 GIS-96	2nd floor Faculty Lounge	696 SF	D	
M-33	Blue baseboard and Mastic	GIS-97 GIS-98 GIS-99	2nd floor faculty lounge and Room 217	1,221 SF	D	
M-34	Black baseboard and Mastic	GIS-100 GIS-101 GIS-102	2nd floor by stairwell	250 SF	D	
M-35	Carpet Mastic	GIS-103 GIS-104 GIS-105	Room 219 and 215	918 SF	D	
M-36	Drywall Joint compound	GIS-106 GIS-107 GIS-108	Rooms 219, 217, and 212	1562 SF	D	
M-37	Black Glue Tar	GIS-109 GIS-110 GIS-111	Steps under stairwell	153 SF	D	
M-38	Drywall	GIS-112 GIS-113 GIS-114	Rooms 217, 212, and 210	1,719 SF	D	
M-39	Pinhole 2x4 ft ceiling tile	GIS-115 GIS-116 GIS-117	217, hallway outside 217	525 SF	D	
M-40	Dark Blue 12x12 in tile	GIS-118 GIS-120 GIS-122	217 and outside of elevator	678 SF	D	

Signature: _____ Date Sampled: 7/29/22 PARS Project #: 1200-48

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EMSL
CINNAMINSON, NJ
22 AUG -1 PM 4:00

OrderID: 042218716

042218716

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 6

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-41	Mastic associated with M-40	GIS-119 GIS-121 GIS-123	217 and Outside of elevator	678 SF	D	
S-42	Plaster joint Compound	GIS-124 GIS-125 GIS-126	2nd floor north	515 SF	D	
M-43	Red 12x12 in tile	GIS-127 GIS-129 GIS-131	Rooms 212, 213 and 208	1857 SF	D	
M-44	Mastic associated with M-43	GIS-128 GIS-130 GIS-132	Rooms 212, 213 and 208	1857 SF	D	
M-45	Tan speckled 12x12 in tile	GIS-133 GIS-135 GIS-137	Rooms 212, 213 and 208	1857 SF	D	
M-46	Mastic associated with M-45	GIS-134 GIS-136 GIS-138	Rooms 212, 213 and 208	1857 SF	D	
S-47	Plaster- White	GIS-139 GIS-141 GIS-143	Steps near stairwell and 217	525 SF	D	
S-48	Plaster- Brown	GIS-140 GIS-142 GIS-144	Steps near stairwell and 217	525 SF	D	
M-49	Light Blue 12x12 in tile	GIS-145 GIS-147 GIS-149	Rooms 210, 209/211, and 200	2,359 SF	D	
M-50	Mastic associated with M-49	GIS-146 GIS-148 GIS-150	Rooms 210, 209/211 and 200	2,359 SF	D	

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Signature: Date Sampled: 7/29/22 PARS Project #: 1200-42

OrderID: 042218716

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 7

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-51	Red Baseboard and Mastic	GIS-151 GIS-152 GIS-153	Rooms 210, 209/211 200	2,359SF	D	
S-52	Plaster-White	GIS-154 GIS-156 GIS-158	Bathroom, Stairwell across bathroom, end of hall	252SF	D	
S-53	Plaster-Brown	GIS-155 GIS-157 GIS-159	Bathroom, Stairwell across bathroom, end of hall	252SF	D	
M-54	Black counters	GIS-160 GIS-161 GIS-162	Rooms 219, 200 and 201	2,408SF	D	
M-55	Linoleum black traction tread	GIS-163 GIS-165 GIS-167	Hallway South to Stairs and stairs	150 SF	D	
M-56	Mastic associated with M-55	GIS-164 GIS-166 GIS-168	Hallway South to stairs and stairs	150 SF	D	
M-57	Pinhole and Circular Crater 2x4ft white ceiling tile	GIS-169 GIS-170 GIS-171	Room 215	222SF	D	
M-58	Pinhole and Oblong Crater 2x4ft white ceiling tile	GIS-172 GIS-173 GIS-174	Room 215	222SF	D	
M-59	Black sink Under-coating	GIS-175 GIS-176 GIS-177	Room 217	525SF	D	
M-60	Dark Red Baseboard and mastic	GIS-178 GIS-179 GIS-180	Room 200 and 202	2212SF	D	

Signature: [signature] Date Sampled: 7/29/22 PARS Project #: 1200-42

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OrderID: 042218716

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042218716

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 8

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-61	Dark Blue Baseboard and mastic	GIS-181 GIS-182 GIS-183	Room 201 and south hallway	1120SF	D	
M-62	White 12x12 in floor tile with grey specks	GIS-184 GIS-186 GIS-188	Rooms 201, 200 and 202	2212SF	D	
M-63	Mastic associated with m-62	GIS-185 GIS-187 GIS-189	Rooms 201, 200 and 202	2212SF	D	
M-64	Red 12x12 in floor tile	GIS-190 GIS-192 GIS-194	Room 201	1120SF	D	
M-65	Mastic associated with m-64	GIS-191 GIS-193 GIS-195	Room 201	1120SF	D	
M-66	Drywall	GIS-196 GIS-197 GIS-198	Rooms 200, 201 and 202	2212SF	D	
M-67	Drywall joint compound	GIS-199 GIS-200 GIS-201	Rooms 200, 201 and 202	2212SF	D	
M-68	Light blue 12x12 in floor tile	GIS-202 GIS-204 GIS-206	Room 200	1092SF	D	
M-69	Floor leveling associated with M-68	GIS-203 GIS-205 GIS-207	Room 200	1092SF	D	
M-70	Hood Backing	GIS-208 GIS-209 GIS-210	200 Prep Room	347SF	D	

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EMSL Order ID:	042218716
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	

Attn: Julian Fernandez-Obregon
PARS Environmental
500 Horizon Drive
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Phone:	(609) 890-7277
Fax:	(609) 890-9116
Collected:	7/28/2022
Received:	8/01/2022
Analyzed:	8/12/2022

Proj: Glassboro Intermediate School / 9 South Broadway, Cape May Court House

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GIS-1 ***Lab Sample ID:*** **042218716-0001**
Sample Description: Third Floor Hallway/Pinhole Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	85.0%	15.0%	None Detected	

Client Sample ID: GIS-2 ***Lab Sample ID:*** **042218716-0002**
Sample Description: Third Floor Hallway/Pinhole Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-3 ***Lab Sample ID:*** **042218716-0003**
Sample Description: Third Floor Hallway/Pinhole Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-4 ***Lab Sample ID:*** **042218716-0004**
Sample Description: Third Floor Hallway/Plaster Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-5 ***Lab Sample ID:*** **042218716-0005**
Sample Description: Third Floor Hallway/Plaster Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-6 ***Lab Sample ID:*** **042218716-0006**
Sample Description: Third Floor Hallway/Plaster Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-7 ***Lab Sample ID:*** **042218716-0007**
Sample Description: Third Floor/White Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GIS-9 ***Lab Sample ID:*** **042218716-0008**
Sample Description: Third Floor/White Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-11 ***Lab Sample ID:*** **042218716-0009**
Sample Description: Third Floor/White Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-8 ***Lab Sample ID:*** **042218716-0010**
Sample Description: Third Floor/Brown Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GIS-10 ***Lab Sample ID:*** **042218716-0011**
Sample Description: Third Floor/Brown Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GIS-12 ***Lab Sample ID:*** **042218716-0012**
Sample Description: Third Floor/Brown Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GIS-13 ***Lab Sample ID:*** **042218716-0013**
Sample Description: Third Floor Rooms/Green Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-15 ***Lab Sample ID:*** **042218716-0014**
Sample Description: Third Floor Rooms/Green Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-17 ***Lab Sample ID:*** **042218716-0015**
Sample Description: Third Floor Rooms/Green Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Green	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GIS-14 ***Lab Sample ID:*** **042218716-0016**

Sample Description: Third Floor Rooms/Mastic associated w/M-5

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-16 ***Lab Sample ID:*** **042218716-0017**

Sample Description: Third Floor Rooms/Mastic associated w/M-5

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-18 ***Lab Sample ID:*** **042218716-0018**

Sample Description: Third Floor Rooms/Mastic associated w/M-5

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-19 ***Lab Sample ID:*** **042218716-0019**

Sample Description: Third Floor Rooms/Green w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-21 ***Lab Sample ID:*** **042218716-0020**

Sample Description: Third Floor Rooms/Green w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-23 ***Lab Sample ID:*** **042218716-0021**

Sample Description: Third Floor Rooms/Green w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-20 ***Lab Sample ID:*** **042218716-0022**

Sample Description: Third Floor Rooms/Mastic associated w/M-7

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Black/Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-24 ***Lab Sample ID:*** **042218716-0023**

Sample Description: Third Floor Rooms/Mastic associated w/M-7

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022				Insufficient Material	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GIS-22 ***Lab Sample ID:*** **042218716-0024**

Sample Description: Third Floor Rooms/Mastic associated w/M-7

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black/Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-25 ***Lab Sample ID:*** **042218716-0025**

Sample Description: Third Floor Rooms/Gray w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Gray	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-27 ***Lab Sample ID:*** **042218716-0026**

Sample Description: Third Floor Rooms/Gray w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Gray	0.0%	100%	None Detected	

Client Sample ID: GIS-29 ***Lab Sample ID:*** **042218716-0027**

Sample Description: Third Floor Rooms/Gray w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-26 ***Lab Sample ID:*** **042218716-0028**

Sample Description: Third Floor Rooms/Mastic associated w/M-9

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022				Insufficient Material	

Client Sample ID: GIS-28 ***Lab Sample ID:*** **042218716-0029**

Sample Description: Third Floor Rooms/Mastic associated w/M-9

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-30 ***Lab Sample ID:*** **042218716-0030**

Sample Description: Third Floor Rooms/Mastic associated w/M-9

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White/Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-31-Patch Compound ***Lab Sample ID:*** **042218716-0031**

Sample Description: Third Floor Room 310 North Stairs/Patch Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Tan/White	0.0%	100.0%	None Detected	Result includes a small amount of inseparable attached material

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GIS-31-Base Coat **Lab Sample ID:** **042218716-0031A**
Sample Description: Third Floor Room 310 North Stairs/Base Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-32-Patch Compound **Lab Sample ID:** **042218716-0032**
Sample Description: Third Floor Room 310 North Stairs/Patch Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Tan/White	0.0%	100.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-32-Base Coat **Lab Sample ID:** **042218716-0032A**
Sample Description: Third Floor Room 310 North Stairs/Base Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-33-Patch Compound **Lab Sample ID:** **042218716-0033**
Sample Description: Third Floor Room 310 North Stairs/Patch Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Tan/White	0.0%	100.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-33-Base Coat **Lab Sample ID:** **042218716-0033A**
Sample Description: Third Floor Room 310 North Stairs/Base Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-34 **Lab Sample ID:** **042218716-0034**
Sample Description: Third Floor Rooms 307 and 308/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-36 **Lab Sample ID:** **042218716-0035**
Sample Description: Third Floor Rooms 307 and 308/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-38 **Lab Sample ID:** **042218716-0036**
Sample Description: Third Floor Rooms 307 and 308/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GIS-35 ***Lab Sample ID:*** **042218716-0037**

Sample Description: Third Floor Rooms 307 and 308/Mastic associated w/M-12

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-37 ***Lab Sample ID:*** **042218716-0038**

Sample Description: Third Floor Rooms 307 and 308/Mastic associated w/M-12

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022				Insufficient Material	

Client Sample ID: GIS-39 ***Lab Sample ID:*** **042218716-0039**

Sample Description: Third Floor Rooms 307 and 308/Mastic associated w/M-12

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-40 ***Lab Sample ID:*** **042218716-0040**

Sample Description: Third Floor Rooms 307 and 308/Blue 12"x12" w/Specks Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-42 ***Lab Sample ID:*** **042218716-0041**

Sample Description: Third Floor Rooms 307 and 308/Blue 12"x12" w/Specks Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-44 ***Lab Sample ID:*** **042218716-0042**

Sample Description: Third Floor Rooms 307 and 308/Blue 12"x12" w/Specks Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-41 ***Lab Sample ID:*** **042218716-0043**

Sample Description: Third Floor Rooms 307 and 308/Mastic associated w/M14

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black/Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-43 ***Lab Sample ID:*** **042218716-0044**

Sample Description: Third Floor Rooms 307 and 308/Mastic associated w/M14

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GIS-45 ***Lab Sample ID:*** **042218716-0045**

Sample Description: Third Floor Rooms 307 and 308/Mastic associated w/M14

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-46 ***Lab Sample ID:*** **042218716-0046**

Sample Description: Third Floor North Stairs/Burgandy Fire Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-47 ***Lab Sample ID:*** **042218716-0047**

Sample Description: Third Floor North Stairs/Burgandy Fire Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-48 ***Lab Sample ID:*** **042218716-0048**

Sample Description: Third Floor North Stairs/Burgandy Fire Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-49 ***Lab Sample ID:*** **042218716-0049**

Sample Description: Third Floor Hallway/Brown / Tan 9"x9 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Brown/Tan	0.0%	95.0%	**5.0% Chrysotile**	

Client Sample ID: GIS-51 ***Lab Sample ID:*** **042218716-0050**

Sample Description: Third Floor Hallway/Brown / Tan 9"x9 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Brown/Tan	0.0%	94.7%	**5.3% Chrysotile**	

Client Sample ID: GIS-53 ***Lab Sample ID:*** **042218716-0051**

Sample Description: Third Floor Hallway/Brown / Tan 9"x9 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Brown/Tan	0.0%	94.1%	**5.9% Chrysotile**	

Client Sample ID: GIS-50 ***Lab Sample ID:*** **042218716-0052**

Sample Description: Third Floor Hallway/Mastic associated w/M-17

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black/Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black/Yellow	0.0%	100.0%	**<0.1% Chrysotile**	

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Client Sample ID: GIS-52 ***Lab Sample ID:*** **042218716-0053**
Sample Description: Third Floor Hallway/Mastic associated w/M-17

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022				Insufficient Material	

Client Sample ID: GIS-54 ***Lab Sample ID:*** **042218716-0054**
Sample Description: Third Floor Hallway/Mastic associated w/M-17

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022				Insufficient Material	

Client Sample ID: GIS-55 ***Lab Sample ID:*** **042218716-0055**
Sample Description: Third Floor 305/Dark Blue 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	**<0.1% Chrysotile**	

Client Sample ID: GIS-57 ***Lab Sample ID:*** **042218716-0056**
Sample Description: Third Floor 305/Dark Blue 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-59 ***Lab Sample ID:*** **042218716-0057**
Sample Description: Third Floor 305/Dark Blue 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-56 ***Lab Sample ID:*** **042218716-0058**
Sample Description: Third Floor 305/Mastic associated w/M-19

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-58 ***Lab Sample ID:*** **042218716-0059**
Sample Description: Third Floor 305/Mastic associated w/M-19

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-60 ***Lab Sample ID:*** **042218716-0060**
Sample Description: Third Floor 305/Mastic associated w/M-19

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

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Client Sample ID: GIS-61 ***Lab Sample ID:*** **042218716-0061**
Sample Description: Third Floor 305/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-62 ***Lab Sample ID:*** **042218716-0062**
Sample Description: Third Floor 305/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-63 ***Lab Sample ID:*** **042218716-0063**
Sample Description: Third Floor 305/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-64 ***Lab Sample ID:*** **042218716-0064**
Sample Description: Third Floor 305/White w/ Gray Spots 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-66 ***Lab Sample ID:*** **042218716-0065**
Sample Description: Third Floor 305/White w/ Gray Spots 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/White	0.0%	100%	None Detected	

Client Sample ID: GIS-68 ***Lab Sample ID:*** **042218716-0066**
Sample Description: Third Floor 305/White w/ Gray Spots 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/White	0.0%	100%	None Detected	

Client Sample ID: GIS-65 ***Lab Sample ID:*** **042218716-0067**
Sample Description: Third Floor 305/Mastic associated w/M-22

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-67 ***Lab Sample ID:*** **042218716-0068**
Sample Description: Third Floor 305/Mastic associated w/M-22

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

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Client Sample ID: GIS-69 ***Lab Sample ID:*** **042218716-0069**

Sample Description: Third Floor 305/Mastic associated w/M-22

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-70 ***Lab Sample ID:*** **042218716-0070**

Sample Description: Third Floor/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-71 ***Lab Sample ID:*** **042218716-0071**

Sample Description: Third Floor/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-72 ***Lab Sample ID:*** **042218716-0072**

Sample Description: Third Floor/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-73 ***Lab Sample ID:*** **042218716-0073**

Sample Description: Third Floor Stairways/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-75 ***Lab Sample ID:*** **042218716-0074**

Sample Description: Third Floor Stairways/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-77 ***Lab Sample ID:*** **042218716-0075**

Sample Description: Third Floor Stairways/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-74 ***Lab Sample ID:*** **042218716-0076**

Sample Description: Third Floor Stairways/Mastic associated w/M25

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-76 ***Lab Sample ID:*** **042218716-0077**
Sample Description: Third Floor Stairways/Mastic associated w/M25

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-78 ***Lab Sample ID:*** **042218716-0078**
Sample Description: Third Floor Stairways/Mastic associated w/M25

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-79 ***Lab Sample ID:*** **042218716-0079**
Sample Description: Attic/Black Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-80 ***Lab Sample ID:*** **042218716-0080**
Sample Description: Attic/Black Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-81 ***Lab Sample ID:*** **042218716-0081**
Sample Description: Attic/Black Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-82 ***Lab Sample ID:*** **042218716-0082**
Sample Description: Attic/Black Sheeting

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	1.2%	98.8%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-83 ***Lab Sample ID:*** **042218716-0083**
Sample Description: Attic/Black Sheeting

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.65%	99.0%	**0.26% Chrysotile**	

Client Sample ID: GIS-84 ***Lab Sample ID:*** **042218716-0084**
Sample Description: Attic/Black Sheeting

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	99.7%	**0.26% Chrysotile**	

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Client Sample ID: GIS-85 ***Lab Sample ID:*** **042218716-0085**
Sample Description: Attic/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-86 ***Lab Sample ID:*** **042218716-0086**
Sample Description: Attic/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-87 ***Lab Sample ID:*** **042218716-0087**
Sample Description: Attic/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-88 ***Lab Sample ID:*** **042218716-0088**
Sample Description: Third Floor Elevator Area/Gray Baseboard Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-89 ***Lab Sample ID:*** **042218716-0089**
Sample Description: Third Floor Elevator Area/Gray Baseboard Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-90 ***Lab Sample ID:*** **042218716-0090**
Sample Description: Third Floor Elevator Area/Gray Baseboard Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-91 ***Lab Sample ID:*** **042218716-0091**
Sample Description: 2nd Floor Faculty Lounge/White Floor Tile with Grey Specks 12x12

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-93 ***Lab Sample ID:*** **042218716-0092**
Sample Description: 2nd Floor Faculty Lounge/White Floor Tile with Grey Specks 12x12

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/White	0.0%	100%	None Detected	

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Client Sample ID: GIS-95 ***Lab Sample ID:*** **042218716-0093**

Sample Description: 2nd Floor Faculty Lounge/White Floor Tile with Grey Specks 12x12

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/White	0.0%	100%	None Detected	

Client Sample ID: GIS-92 ***Lab Sample ID:*** **042218716-0094**

Sample Description: 2nd Floor Faculty Lounge/Mastic associated w/M-31

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-94 ***Lab Sample ID:*** **042218716-0095**

Sample Description: 2nd Floor Faculty Lounge/Mastic associated w/M-31

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-96 ***Lab Sample ID:*** **042218716-0096**

Sample Description: 2nd Floor Faculty Lounge/Mastic associated w/M-31

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-97-Baseboard ***Lab Sample ID:*** **042218716-0097**

Sample Description: 2nd Floor Faculty Lounge and Room 217/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-97-Mastic ***Lab Sample ID:*** **042218716-0097A**

Sample Description: 2nd Floor Faculty Lounge and Room 217/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-98-Baseboard ***Lab Sample ID:*** **042218716-0098**

Sample Description: 2nd Floor Faculty Lounge and Room 217/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-98-Mastic ***Lab Sample ID:*** **042218716-0098A**

Sample Description: 2nd Floor Faculty Lounge and Room 217/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

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Client Sample ID: GIS-99-Baseboard ***Lab Sample ID:*** **042218716-0099**

Sample Description: 2nd Floor Faculty Lounge and Room 217/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-99-Mastic ***Lab Sample ID:*** **042218716-0099A**

Sample Description: 2nd Floor Faculty Lounge and Room 217/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-100-Baseboard ***Lab Sample ID:*** **042218716-0100**

Sample Description: 2nd Floor by Stairwell/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-100-Mastic ***Lab Sample ID:*** **042218716-0100A**

Sample Description: 2nd Floor by Stairwell/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-101-Baseboard ***Lab Sample ID:*** **042218716-0101**

Sample Description: 2nd Floor by Stairwell/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-101A-Mastic ***Lab Sample ID:*** **042218716-0101A**

Sample Description: 2nd Floor by Stairwell/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-102-Baseboard ***Lab Sample ID:*** **042218716-0102**

Sample Description: 2nd Floor by Stairwell/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-102-Mastic ***Lab Sample ID:*** **042218716-0102A**

Sample Description: 2nd Floor by Stairwell/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

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Client Sample ID: GIS-103 ***Lab Sample ID:*** **042218716-0103**
Sample Description: Room 219 and 215/Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-104 ***Lab Sample ID:*** **042218716-0104**
Sample Description: Room 219 and 215/Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-105 ***Lab Sample ID:*** **042218716-0105**
Sample Description: Room 219 and 215/Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-106 ***Lab Sample ID:*** **042218716-0106**
Sample Description: Room 219,217, and 212/Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-107 ***Lab Sample ID:*** **042218716-0107**
Sample Description: Room 219,217, and 212/Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-108 ***Lab Sample ID:*** **042218716-0108**
Sample Description: Room 219,217, and 212/Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-109 ***Lab Sample ID:*** **042218716-0109**
Sample Description: Steps Under Stairwell/Black Glue Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	97.4%	**2.6% Chrysotile**	

Client Sample ID: GIS-110 ***Lab Sample ID:*** **042218716-0110**
Sample Description: Steps Under Stairwell/Black Glue Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	97.7%	**2.3% Chrysotile**	

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Client Sample ID: GIS-111 ***Lab Sample ID:*** **042218716-0111**

Sample Description: Steps Under Stairwell/Black Glue Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	97.5%	**2.5% Chrysotile**	

Client Sample ID: GIS-112 ***Lab Sample ID:*** **042218716-0112**

Sample Description: Room 217. 212 and 210/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-113 ***Lab Sample ID:*** **042218716-0113**

Sample Description: Room 217. 212 and 210/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-114 ***Lab Sample ID:*** **042218716-0114**

Sample Description: Room 217. 212 and 210/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown/White	18.0%	82.0%	None Detected	

Client Sample ID: GIS-115 ***Lab Sample ID:*** **042218716-0115**

Sample Description: 217 Hallway Outside 217/Pinhole 2x4 Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-116 ***Lab Sample ID:*** **042218716-0116**

Sample Description: 217 Hallway Outside 217/Pinhole 2x4 Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	85.0%	15.0%	None Detected	

Client Sample ID: GIS-117 ***Lab Sample ID:*** **042218716-0117**

Sample Description: 217 Hallway Outside 217/Pinhole 2x4 Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-118 ***Lab Sample ID:*** **042218716-0118**

Sample Description: 217 and Outside of Elevator/Dark Blue 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-120 ***Lab Sample ID:*** **042218716-0119**

Sample Description: 217 and Outside of Elevator/Dark Blue 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-122 ***Lab Sample ID:*** **042218716-0120**

Sample Description: 217 and Outside of Elevator/Dark Blue 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-119 ***Lab Sample ID:*** **042218716-0121**

Sample Description: 217 and Outside of Elevator/Mastic associated w/M-40

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-121 ***Lab Sample ID:*** **042218716-0122**

Sample Description: 217 and Outside of Elevator/Mastic associated w/M-40

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-123 ***Lab Sample ID:*** **042218716-0123**

Sample Description: 217 and Outside of Elevator/Mastic associated w/M-40

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-124-Skim Coat ***Lab Sample ID:*** **042218716-0124**

Sample Description: 2nd Floor North/Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-124-Base Coat ***Lab Sample ID:*** **042218716-0124A**

Sample Description: 2nd Floor North/Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-124-Joint Compound ***Lab Sample ID:*** **042218716-0124B**

Sample Description: 2nd Floor North/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-125-Skim Coat ***Lab Sample ID:*** **042218716-0125**
Sample Description: 2nd Floor North/Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-125-Base Coat ***Lab Sample ID:*** **042218716-0125A**
Sample Description: 2nd Floor North/Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-125-Joint Compound ***Lab Sample ID:*** **042218716-0125B**
Sample Description: 2nd Floor North/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-126-Skim Coat ***Lab Sample ID:*** **042218716-0126**
Sample Description: 2nd Floor North/Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-126-Base Coat ***Lab Sample ID:*** **042218716-0126A**
Sample Description: 2nd Floor North/Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-126-Joint Compound ***Lab Sample ID:*** **042218716-0126B**
Sample Description: 2nd Floor North/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-127 ***Lab Sample ID:*** **042218716-0127**
Sample Description: Rooms 212, 213 and 208/Red 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-129 ***Lab Sample ID:*** **042218716-0128**
Sample Description: Rooms 212, 213 and 208/Red 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

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Client Sample ID: GIS-131 ***Lab Sample ID:*** **042218716-0129**

Sample Description: Rooms 212, 213 and 208/Red 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-128 ***Lab Sample ID:*** **042218716-0130**

Sample Description: Rooms 212, 213 and 208/Mastic associated w/M-43

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-130 ***Lab Sample ID:*** **042218716-0131**

Sample Description: Rooms 212, 213 and 208/Mastic associated w/M-43

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-132 ***Lab Sample ID:*** **042218716-0132**

Sample Description: Rooms 212, 213 and 208/Mastic associated w/M-43

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black/Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-133 ***Lab Sample ID:*** **042218716-0133**

Sample Description: Rooms 212, 213 and 208/Tan Speckled 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Tan	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Tan	0.0%	100.0%	None Detected	

Client Sample ID: GIS-135 ***Lab Sample ID:*** **042218716-0134**

Sample Description: Rooms 212, 213 and 208/Tan Speckled 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-137 ***Lab Sample ID:*** **042218716-0135**

Sample Description: Rooms 212, 213 and 208/Tan Speckled 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-134 ***Lab Sample ID:*** **042218716-0136**

Sample Description: Rooms 212, 213 and 208/Mastic associated w/M45

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black/Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black/Yellow	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-136 ***Lab Sample ID:*** **042218716-0137**

Sample Description: Rooms 212, 213 and 208/Mastic associated w/M45

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-138 ***Lab Sample ID:*** **042218716-0138**

Sample Description: Rooms 212, 213 and 208/Mastic associated w/M45

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-139 ***Lab Sample ID:*** **042218716-0139**

Sample Description: Steps Near Stairs and 217/Plaster -White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Tan/White	0.0%	100.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-141 ***Lab Sample ID:*** **042218716-0140**

Sample Description: Steps Near Stairs and 217/Plaster -White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-143 ***Lab Sample ID:*** **042218716-0141**

Sample Description: Steps Near Stairs and 217/Plaster -White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-140 ***Lab Sample ID:*** **042218716-0142**

Sample Description: Steps Hear Stairwell and 217/Plaster Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GIS-142 ***Lab Sample ID:*** **042218716-0143**

Sample Description: Steps Hear Stairwell and 217/Plaster Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GIS-144 ***Lab Sample ID:*** **042218716-0144**

Sample Description: Steps Hear Stairwell and 217/Plaster Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-145 ***Lab Sample ID:*** **042218716-0145**

Sample Description: Rooms 210 209/211 and 200/Light Blue 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-147 ***Lab Sample ID:*** **042218716-0146**

Sample Description: Rooms 210 209/211 and 200/Light Blue 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-149 ***Lab Sample ID:*** **042218716-0147**

Sample Description: Rooms 210 209/211 and 200/Light Blue 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-146 ***Lab Sample ID:*** **042218716-0148**

Sample Description: Rooms 210, 209/211 and 200/Mastic assocaited w/M-49

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black/Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-148 ***Lab Sample ID:*** **042218716-0149**

Sample Description: Rooms 210, 209/211 and 200/Mastic assocaited w/M-49

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-150 ***Lab Sample ID:*** **042218716-0150**

Sample Description: Rooms 210, 209/211 and 200/Mastic assocaited w/M-49

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-151-Baseboard ***Lab Sample ID:*** **042218716-0151**

Sample Description: Rooms 210, 209/211 and 200/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Red	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-151-Mastic ***Lab Sample ID:*** **042218716-0151A**

Sample Description: Rooms 210, 209/211 and 200/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow/Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Yellow/Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-152-Baseboard ***Lab Sample ID:*** **042218716-0152**

Sample Description: Rooms 210, 209/211 and 200/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-152-Mastic ***Lab Sample ID:*** **042218716-0152A**

Sample Description: Rooms 210, 209/211 and 200/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow/Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-153-Baseboard ***Lab Sample ID:*** **042218716-0153**

Sample Description: Rooms 210, 209/211 and 200/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-153-Mastic ***Lab Sample ID:*** **042218716-0153A**

Sample Description: Rooms 210, 209/211 and 200/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow/Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-154 ***Lab Sample ID:*** **042218716-0154**

Sample Description: Bathroom Stairwell Across Bathroom End of Hall/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-156 ***Lab Sample ID:*** **042218716-0155**

Sample Description: Bathroom Stairwell Across Bathroom End of Hall/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-158 ***Lab Sample ID:*** **042218716-0156**

Sample Description: Bathroom Stairwell Across Bathroom End of Hall/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-155 ***Lab Sample ID:*** **042218716-0157**

Sample Description: Bathroom Stairwell Across Bathroom End of Hall/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown/Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-157 ***Lab Sample ID:*** **042218716-0158**

Sample Description: Bathroom Stairwell Across Bathroom End of Hall/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown/Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-159 ***Lab Sample ID:*** **042218716-0159**

Sample Description: Bathroom Stairwell Across Bathroom End of Hall/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown/Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-160 ***Lab Sample ID:*** **042218716-0160**

Sample Description: Rooms 219, 200 and 201/Black Counters

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-161 ***Lab Sample ID:*** **042218716-0161**

Sample Description: Rooms 219, 200 and 201/Black Counters

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-162 ***Lab Sample ID:*** **042218716-0162**

Sample Description: Rooms 219, 200 and 201/Black Counters

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-163 ***Lab Sample ID:*** **042218716-0163**

Sample Description: Hallway South to Stairs/Linoleum Black Traction Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-165 ***Lab Sample ID:*** **042218716-0164**

Sample Description: Hallway South to Stairs/Linoleum Black Traction Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GIS-167 ***Lab Sample ID:*** **042218716-0165**

Sample Description: Hallway South to Stairs/Linoleum Black Traction Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-164 ***Lab Sample ID:*** **042218716-0166**

Sample Description: Hallway South to Stairs/Mastic associated w/M-55

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-166 ***Lab Sample ID:*** **042218716-0167**

Sample Description: Hallway South to Stairs/Mastic associated w/M-55

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-168 ***Lab Sample ID:*** **042218716-0168**

Sample Description: Hallway South to Stairs/Mastic associated w/M-55

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-169 ***Lab Sample ID:*** **042218716-0169**

Sample Description: Room 215/Pinhole and Circular Crater 2x4 White Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	85.0%	15.0%	None Detected	

Client Sample ID: GIS-170 ***Lab Sample ID:*** **042218716-0170**

Sample Description: Room 215/Pinhole and Circular Crater 2x4 White Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-171 ***Lab Sample ID:*** **042218716-0171**

Sample Description: Room 215/Pinhole and Circular Crater 2x4 White Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-172 ***Lab Sample ID:*** **042218716-0172**

Sample Description: Room 215/Pinhole and Oblong Crater 2x4 White Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	80.0%	20.0%	None Detected	

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Client Sample ID: GIS-173 ***Lab Sample ID:*** **042218716-0173**
Sample Description: Room 215/Pinhole and Oblong Crater 2x4 White Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-174 ***Lab Sample ID:*** **042218716-0174**
Sample Description: Room 215/Pinhole and Oblong Crater 2x4 White Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-175 ***Lab Sample ID:*** **042218716-0175**
Sample Description: Room 217/Black Sink Under Coating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-176 ***Lab Sample ID:*** **042218716-0176**
Sample Description: Room 217/Black Sink Under Coating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-177 ***Lab Sample ID:*** **042218716-0177**
Sample Description: Room 217/Black Sink Under Coating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-178-Baseboard ***Lab Sample ID:*** **042218716-0178**
Sample Description: Room 200 and 202/Dark Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-178-Mastic ***Lab Sample ID:*** **042218716-0178A**
Sample Description: Room 200 and 202/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-179-Baseboard ***Lab Sample ID:*** **042218716-0179**
Sample Description: Room 200 and 202/Dark Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

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Client Sample ID: GIS-179-Mastic **Lab Sample ID:** **042218716-0179A**

Sample Description: Room 200 and 202/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-180-Baseboard **Lab Sample ID:** **042218716-0180**

Sample Description: Room 200 and 202/Dark Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-180-Mastic **Lab Sample ID:** **042218716-0180A**

Sample Description: Room 200 and 202/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-181-Baseboard **Lab Sample ID:** **042218716-0181**

Sample Description: Room 201 and South Hallway/Dark Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-181-Mastic **Lab Sample ID:** **042218716-0181A**

Sample Description: Room 201 and South Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-182-Baseboard **Lab Sample ID:** **042218716-0182**

Sample Description: Room 201 and South Hallway/Dark Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-182-Mastic **Lab Sample ID:** **042218716-0182A**

Sample Description: Room 201 and South Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-183-Baseboard **Lab Sample ID:** **042218716-0183**

Sample Description: Room 201 and South Hallway/Dark Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

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Client Sample ID: GIS-183-Mastic ***Lab Sample ID:*** **042218716-0183A**

Sample Description: Room 201 and South Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-184 ***Lab Sample ID:*** **042218716-0184**

Sample Description: Room 201, 200 and 202/White 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-186 ***Lab Sample ID:*** **042218716-0185**

Sample Description: Room 201, 200 and 202/White 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-188 ***Lab Sample ID:*** **042218716-0186**

Sample Description: Room 201, 200 and 202/White 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-185 ***Lab Sample ID:*** **042218716-0187**

Sample Description: Room 201, 200 and 202/Mastic assocaited w/M-62

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-187 ***Lab Sample ID:*** **042218716-0188**

Sample Description: Room 201, 200 and 202/Mastic assocaited w/M-62

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-189 ***Lab Sample ID:*** **042218716-0189**

Sample Description: Room 201, 200 and 202/Mastic assocaited w/M-62

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022				Insufficient Material	

Client Sample ID: GIS-190 ***Lab Sample ID:*** **042218716-0190**

Sample Description: Room 201/Red 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Red	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-192 ***Lab Sample ID:*** **042218716-0191**
Sample Description: Room 201/Red 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-194 ***Lab Sample ID:*** **042218716-0192**
Sample Description: Room 201/Red 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-191 ***Lab Sample ID:*** **042218716-0193**
Sample Description: Room 201/Mastic associated w/M-64

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-193 ***Lab Sample ID:*** **042218716-0194**
Sample Description: Room 201/Mastic associated w/M-64

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-195 ***Lab Sample ID:*** **042218716-0195**
Sample Description: Room 201/Mastic associated w/M-64

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-196 ***Lab Sample ID:*** **042218716-0196**
Sample Description: Room 201, 200 and 202/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown/White	17.0%	83.0%	None Detected	

Client Sample ID: GIS-197 ***Lab Sample ID:*** **042218716-0197**
Sample Description: Room 201, 200 and 202/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown/White	17.0%	83.0%	None Detected	

Client Sample ID: GIS-198 ***Lab Sample ID:*** **042218716-0198**
Sample Description: Room 201, 200 and 202/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown/White	15.0%	85.0%	None Detected	

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Client Sample ID: GIS-199 ***Lab Sample ID:*** **042218716-0199**
Sample Description: Room 201, 200 and 202/Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-200 ***Lab Sample ID:*** **042218716-0200**
Sample Description: Room 201, 200 and 202/Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-201 ***Lab Sample ID:*** **042218716-0201**
Sample Description: Room 201, 200 and 202/Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-202 ***Lab Sample ID:*** **042218716-0202**
Sample Description: Room 200/Light Blue 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-204 ***Lab Sample ID:*** **042218716-0203**
Sample Description: Room 200/Light Blue 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-206 ***Lab Sample ID:*** **042218716-0204**
Sample Description: Room 200/Light Blue 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-203 ***Lab Sample ID:*** **042218716-0205**
Sample Description: Room 200/Floor Leveling associated with M-68

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Gray/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-205 ***Lab Sample ID:*** **042218716-0206**
Sample Description: Room 200/Floor Leveling associated with M-68

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/Yellow	0.0%	100%	None Detected	

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Client Sample ID: GIS-207 ***Lab Sample ID:*** **042218716-0207**

Sample Description: Room 200/Floor Leveling associated with M-68

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/Yellow	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-208 ***Lab Sample ID:*** **042218716-0208**

Sample Description: 200 Prep Room/Hood Backing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Brown/White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Brown/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-209 ***Lab Sample ID:*** **042218716-0209**

Sample Description: 200 Prep Room/Hood Backing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Brown/White	0.0%	100%	None Detected	

Client Sample ID: GIS-210 ***Lab Sample ID:*** **042218716-0210**

Sample Description: 200 Prep Room/Hood Backing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Brown/White	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Analyst(s):

Laura Kantor	PLM (36) PLM Grav. Reduction (13)
Michelle Quach	PLM (28) PLM Grav. Reduction (68)
Rachel Irwin	TEM Grav. Reduction (37)
Sarah Kleinbrahm	PLM (5) PLM Grav. Reduction (78)
Seri Smith	TEM Grav. Reduction (16)

Reviewed and approved by:

Samantha Rundstrom, Laboratory Manager
or Other Approved Signatory

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Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NVLAP Lab Code 101048-0, AIHA-LAP, LLC-IHLAP Lab 100194, NJ DEP 03036, PA ID# 68-00367, LA #04127

Initial report from: 08/12/202214:24:18

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Customer ID:	PARS51
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Collected:	7/29/2022
Received:	8/09/2022
Analyzed:	8/21/2022

Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-211-Stair Tread **Lab Sample ID:** **042219669-0001**
Sample Description: South Stairs/Dark Blue Stair Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-211-Mastic **Lab Sample ID:** **042219669-0001A**
Sample Description: South Stairs/Dark Blue Stair Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-212-Stair Tread **Lab Sample ID:** **042219669-0002**
Sample Description: South Stairs/Dark Blue Stair Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-212-Mastic **Lab Sample ID:** **042219669-0002A**
Sample Description: South Stairs/Dark Blue Stair Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-213-Stair Tread **Lab Sample ID:** **042219669-0003**
Sample Description: South Stairs/Dark Blue Stair Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-213-Mastic **Lab Sample ID:** **042219669-0003A**
Sample Description: South Stairs/Dark Blue Stair Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-214 **Lab Sample ID:** **042219669-0004**
Sample Description: 1st Level by Room 114/Dark Blue Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-216 ***Lab Sample ID:*** **042219669-0005**

Sample Description: 1st Level by Room 114/Dark Blue Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-218 ***Lab Sample ID:*** **042219669-0006**

Sample Description: 1st Level by Room 114/Dark Blue Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-215 ***Lab Sample ID:*** **042219669-0007**

Sample Description: 1st Level by Room 114/Mastic associated w/M-72

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-217 ***Lab Sample ID:*** **042219669-0008**

Sample Description: 1st Level by Room 114/Mastic associated w/M-72

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022				Insufficient Material	

Client Sample ID: GIS-219 ***Lab Sample ID:*** **042219669-0009**

Sample Description: 1st Level by Room 114/Mastic associated w/M-72

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-220 ***Lab Sample ID:*** **042219669-0010**

Sample Description: 1st Level by Room 114/White w/Gray Specks 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Gray/White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-222 ***Lab Sample ID:*** **042219669-0011**

Sample Description: 1st Level by Room 114/White w/Gray Specks 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Gray/White	0.0%	100%	None Detected	

Client Sample ID: GIS-224 ***Lab Sample ID:*** **042219669-0012**

Sample Description: 1st Level by Room 114/White w/Gray Specks 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Gray/White	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-221 ***Lab Sample ID:*** **042219669-0013**

Sample Description: 1st Level by Room 114/Mastic assocaited w/ M-74

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-223 ***Lab Sample ID:*** **042219669-0014**

Sample Description: 1st Level by Room 114/Mastic assocaited w/ M-74

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-225 ***Lab Sample ID:*** **042219669-0015**

Sample Description: 1st Level by Room 114/Mastic assocaited w/ M-74

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-226-Baseboard ***Lab Sample ID:*** **042219669-0016**

Sample Description: Room 114/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-226-Mastic ***Lab Sample ID:*** **042219669-0016A**

Sample Description: Room 114/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-227-Baseboard ***Lab Sample ID:*** **042219669-0017**

Sample Description: Room 114/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-227-Mastic ***Lab Sample ID:*** **042219669-0017A**

Sample Description: Room 114/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-228-Baseboard ***Lab Sample ID:*** **042219669-0018**

Sample Description: Room 114/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Red	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-228-Mastic ***Lab Sample ID:*** **042219669-0018A**

Sample Description: Room 114/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-229-Baseboard ***Lab Sample ID:*** **042219669-0019**

Sample Description: Hallway Outside Library, Library/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-229-Mastic ***Lab Sample ID:*** **042219669-0019A**

Sample Description: Hallway Outside Library, Library/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-230-Baseboard ***Lab Sample ID:*** **042219669-0020**

Sample Description: Hallway Outside Library, Library/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-230-Mastic ***Lab Sample ID:*** **042219669-0020A**

Sample Description: Hallway Outside Library, Library/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-231-Baseboard ***Lab Sample ID:*** **042219669-0021**

Sample Description: Hallway Outside Library, Library/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-231-Mastic ***Lab Sample ID:*** **042219669-0021A**

Sample Description: Hallway Outside Library, Library/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-232 ***Lab Sample ID:*** **042219669-0022**

Sample Description: Library and Room 114/Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-233 ***Lab Sample ID:*** **042219669-0023**

Sample Description: Library and Room 114/Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-234 ***Lab Sample ID:*** **042219669-0024**

Sample Description: Library and Room 114/Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-235 ***Lab Sample ID:*** **042219669-0025**

Sample Description: Library, Hallway Outside Library, Closet Across 114/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-237 ***Lab Sample ID:*** **042219669-0026**

Sample Description: Library, Hallway Outside Library, Closet Across 114/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-239 ***Lab Sample ID:*** **042219669-0027**

Sample Description: Library, Hallway Outside Library, Closet Across 114/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-236 ***Lab Sample ID:*** **042219669-0028**

Sample Description: Library, Hallway Outside Library, Closet Across 114/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/Gray	5.0%	95.0%	None Detected	

Client Sample ID: GIS-238 ***Lab Sample ID:*** **042219669-0029**

Sample Description: Library, Hallway Outside Library, Closet Across 114/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-240 ***Lab Sample ID:*** **042219669-0030**

Sample Description: Library, Hallway Outside Library, Closet Across 114/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-241 ***Lab Sample ID:*** **042219669-0031**

Sample Description: Inside Storage Near 116, Room 116 and 114/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: GIS-242 ***Lab Sample ID:*** **042219669-0032**

Sample Description: Inside Storage Near 116, Room 116 and 114/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: GIS-243 ***Lab Sample ID:*** **042219669-0033**

Sample Description: Inside Storage Near 116, Room 116 and 114/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: GIS-244 ***Lab Sample ID:*** **042219669-0034**

Sample Description: Hallway Outside Library/Pinhole White 2'x4' Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-245 ***Lab Sample ID:*** **042219669-0035**

Sample Description: Hallway Outside Library/Pinhole White 2'x4' Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-246 ***Lab Sample ID:*** **042219669-0036**

Sample Description: Hallway Outside Library/Pinhole White 2'x4' Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray/White	90.0%	10.0%	None Detected	

Client Sample ID: GIS-247 ***Lab Sample ID:*** **042219669-0037**

Sample Description: Inside Storage Near 116, Hall Outisde Storage, Outside 114/Pinhole with Small Circular Crater White 2'x4' Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-248 ***Lab Sample ID:*** **042219669-0038**

Sample Description: Inside Storage Near 116, Hall Outisde Storage, Outside 114/Pinhole with Small Circular Crater White 2'x4' Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Gray/White	80.0%	20.0%	None Detected	

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Client Sample ID: GIS-249 ***Lab Sample ID:*** **042219669-0039**

Sample Description: Inside Storage Near 116, Hall Outisde Storage, Outside 114/Pinhole with Small Circular Crater White 2'x4' Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray/White	90.0%	10.0%	None Detected	

Client Sample ID: GIS-250 ***Lab Sample ID:*** **042219669-0040**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-251 ***Lab Sample ID:*** **042219669-0041**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-252 ***Lab Sample ID:*** **042219669-0042**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-253 ***Lab Sample ID:*** **042219669-0043**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-254 ***Lab Sample ID:*** **042219669-0044**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-255 ***Lab Sample ID:*** **042219669-0045**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown/White	30.0%	70.0%	None Detected	

Client Sample ID: GIS-256 ***Lab Sample ID:*** **042219669-0046**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown/White	30.0%	70.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-257 ***Lab Sample ID:*** **042219669-0047**

Sample Description: Corridor Before Gym North and South/Black Window Ledge

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-258 ***Lab Sample ID:*** **042219669-0048**

Sample Description: Corridor Before Gym North and South/Black Window Ledge

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-259 ***Lab Sample ID:*** **042219669-0049**

Sample Description: Corridor Before Gym North and South/Black Window Ledge

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-260 ***Lab Sample ID:*** **042219669-0050**

Sample Description: Office 110 in Boys Locker Room and Office 111 in Girls Locker Room/Tan 12x12in Floor Tile with Colored Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Tan	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Tan	0.0%	100.0%	None Detected	

Client Sample ID: GIS-262 ***Lab Sample ID:*** **042219669-0051**

Sample Description: Office 110 in Boys Locker Room and Office 111 in Girls Locker Room/Tan 12x12in Floor Tile with Colored Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-264 ***Lab Sample ID:*** **042219669-0052**

Sample Description: Office 110 in Boys Locker Room and Office 111 in Girls Locker Room/Tan 12x12in Floor Tile with Colored Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-261 ***Lab Sample ID:*** **042219669-0053**

Sample Description: Office 110 in Boys Locker Room and Office 111 in Girls Locker Room/Mastic assocaited w/M-86

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-263 ***Lab Sample ID:*** **042219669-0054**

Sample Description: Office 110 in Boys Locker Room and Office 111 in Girls Locker Room/Mastic assocaited w/M-86

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

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Client Sample ID: GIS-265 ***Lab Sample ID:*** **042219669-0055**

Sample Description: Office 110 in Boys Locker Room and Office 111 in Girls Locker Room/Mastic assocaited w/M-86

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-266 ***Lab Sample ID:*** **042219669-0056**

Sample Description: Room 114, Across 114, Across Storage Near 116/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-267 ***Lab Sample ID:*** **042219669-0057**

Sample Description: Room 114, Across 114, Across Storage Near 116/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-268 ***Lab Sample ID:*** **042219669-0058**

Sample Description: Room 114, Across 114, Across Storage Near 116/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-269 ***Lab Sample ID:*** **042219669-0059**

Sample Description: North Stair Area/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-271 ***Lab Sample ID:*** **042219669-0060**

Sample Description: North Stair Area/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-273 ***Lab Sample ID:*** **042219669-0061**

Sample Description: North Stair Area/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-270 ***Lab Sample ID:*** **042219669-0062**

Sample Description: North Stair Area/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown	10.0%	90.0%	None Detected	

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Client Sample ID: GIS-272 ***Lab Sample ID:*** **042219669-0063**

Sample Description: North Stair Area/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown	10.0%	90.0%	None Detected	

Client Sample ID: GIS-274 ***Lab Sample ID:*** **042219669-0064**

Sample Description: North Stair Area/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown	4.0%	96.0%	None Detected	

Client Sample ID: GIS-275 ***Lab Sample ID:*** **042219669-0065**

Sample Description: Room 109/Red 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-277 ***Lab Sample ID:*** **042219669-0066**

Sample Description: Room 109/Red 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-279 ***Lab Sample ID:*** **042219669-0067**

Sample Description: Room 109/Red 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-276 ***Lab Sample ID:*** **042219669-0068**

Sample Description: Room 109/Mastic associated w/M-91

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow/Clear	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow/Clear	0.0%	100.0%	None Detected	

Client Sample ID: GIS-278 ***Lab Sample ID:*** **042219669-0069**

Sample Description: Room 109/Mastic associated w/M-91

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow/Clear	0.0%	100%	None Detected	

Client Sample ID: GIS-280 ***Lab Sample ID:*** **042219669-0070**

Sample Description: Room 109/Mastic associated w/M-91

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow/Clear	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

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Client Sample ID: GIS-281-Baseboard **Lab Sample ID:** **042219669-0071**
Sample Description: Room 109/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-281-Mastic **Lab Sample ID:** **042219669-0071A**
Sample Description: Room 109/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS282-Baseboard **Lab Sample ID:** **042219669-0072**
Sample Description: Room 109/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-282-Mastic **Lab Sample ID:** **042219669-0072A**
Sample Description: Room 109/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-283-Baseboard **Lab Sample ID:** **042219669-0073**
Sample Description: Room 109/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-283-Mastic **Lab Sample ID:** **042219669-0073A**
Sample Description: Room 109/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-284 **Lab Sample ID:** **042219669-0074**
Sample Description: Room 107/Dark Green Tile with Colored Specks 12"X12"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-286 **Lab Sample ID:** **042219669-0075**
Sample Description: Room 107/Dark Green Tile with Colored Specks 12"X12"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-288 ***Lab Sample ID:*** **042219669-0076**

Sample Description: Room 107/Dark Green Tile with Colored Specks 12"X12"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-285 ***Lab Sample ID:*** **042219669-0077**

Sample Description: Room 107/Mastic associated w/M-94

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow/Clear	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow/Clear	0.0%	100.0%	None Detected	

Client Sample ID: GIS-287 ***Lab Sample ID:*** **042219669-0078**

Sample Description: Room 107/Mastic associated w/M-94

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow/Clear	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-289 ***Lab Sample ID:*** **042219669-0079**

Sample Description: Room 107/Mastic associated w/M-94

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022				Insufficient Material	

Client Sample ID: GIS-290-Baseboard ***Lab Sample ID:*** **042219669-0080**

Sample Description: Room 107/Green Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-290-Mastic ***Lab Sample ID:*** **042219669-0080A**

Sample Description: Room 107/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-291-Baseboard ***Lab Sample ID:*** **042219669-0081**

Sample Description: Room 107/Green Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-291-Mastic ***Lab Sample ID:*** **042219669-0081A**

Sample Description: Room 107/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

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Client Sample ID: GIS-292-Baseboard **Lab Sample ID:** **042219669-0082**
Sample Description: Room 107/Green Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-292-Mastic **Lab Sample ID:** **042219669-0082A**
Sample Description: Room 107/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-293-Baseboard **Lab Sample ID:** **042219669-0083**
Sample Description: By Stairways/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-293-Mastic **Lab Sample ID:** **042219669-0083A**
Sample Description: By Stairways/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-294-Baseboard **Lab Sample ID:** **042219669-0084**
Sample Description: By Stairways/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-294-Mastic **Lab Sample ID:** **042219669-0084A**
Sample Description: By Stairways/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-295-Baseboard **Lab Sample ID:** **042219669-0085**
Sample Description: By Stairways/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-295-Mastic **Lab Sample ID:** **042219669-0085A**
Sample Description: By Stairways/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-296 ***Lab Sample ID:*** **042219669-0086**

Sample Description: Room 110-1, Principals Office and Staff Rm 105/Light Green Tile with White Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-298 ***Lab Sample ID:*** **042219669-0087**

Sample Description: Room 110-1, Principals Office and Staff Rm 105/Light Green Tile with White Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-300 ***Lab Sample ID:*** **042219669-0088**

Sample Description: Room 110-1, Principals Office and Staff Rm 105/Light Green Tile with White Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-297 ***Lab Sample ID:*** **042219669-0089**

Sample Description: Room 110-1, Principals Office and Staff Rm 105/Mastic assocaited w/M-98

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-299 ***Lab Sample ID:*** **042219669-0090**

Sample Description: Room 110-1, Principals Office and Staff Rm 105/Mastic assocaited w/M-98

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-301 ***Lab Sample ID:*** **042219669-0091**

Sample Description: Room 110-1, Principals Office and Staff Rm 105/Mastic assocaited w/M-98

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-302-Baseboard ***Lab Sample ID:*** **042219669-0092**

Sample Description: Main Office/Burgandy Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-302-Mastic ***Lab Sample ID:*** **042219669-0092A**

Sample Description: Main Office/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-303-Baseboard ***Lab Sample ID:*** **042219669-0093**

Sample Description: Main Office/Burgandy Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-303-Mastic ***Lab Sample ID:*** **042219669-0093A**

Sample Description: Main Office/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-304-Baseboard ***Lab Sample ID:*** **042219669-0094**

Sample Description: Main Office/Burgandy Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-304-Mastic ***Lab Sample ID:*** **042219669-0094A**

Sample Description: Main Office/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-305 ***Lab Sample ID:*** **042219669-0095**

Sample Description: Rooms 109, 107, and 105/12"x12" Tan w/Colored Specks Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Tan	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Tan	0.0%	100.0%	None Detected	

Client Sample ID: GIS-307 ***Lab Sample ID:*** **042219669-0096**

Sample Description: Rooms 109, 107, and 105/12"x12" Tan w/Colored Specks Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-309 ***Lab Sample ID:*** **042219669-0097**

Sample Description: Rooms 109, 107, and 105/12"x12" Tan w/Colored Specks Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-306 ***Lab Sample ID:*** **042219669-0098**

Sample Description: Rooms 109, 107, and 105/Mastic associated w/M-101

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022				Insufficient Material	

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Client Sample ID: GIS-308 ***Lab Sample ID:*** **042219669-0099**

Sample Description: Rooms 109, 107, and 105/Mastic associated w/M-101

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-310 ***Lab Sample ID:*** **042219669-0100**

Sample Description: Rooms 109, 107, and 105/Mastic associated w/M-101

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022				Insufficient Material	

Client Sample ID: GIS-311 ***Lab Sample ID:*** **042219669-0101**

Sample Description: Main Office/Yellow Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-312 ***Lab Sample ID:*** **042219669-0102**

Sample Description: Main Office/Yellow Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-313 ***Lab Sample ID:*** **042219669-0103**

Sample Description: Main Office/Yellow Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-314 ***Lab Sample ID:*** **042219669-0104**

Sample Description: Noth Stairwell, South Stairwell, Room 107/Pinhole Ceiling Tile 2'x4' White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-315 ***Lab Sample ID:*** **042219669-0105**

Sample Description: Noth Stairwell, South Stairwell, Room 107/Pinhole Ceiling Tile 2'x4' White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-316 ***Lab Sample ID:*** **042219669-0106**

Sample Description: Noth Stairwell, South Stairwell, Room 107/Pinhole Ceiling Tile 2'x4' White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	80.0%	20.0%	None Detected	

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Client Sample ID: GIS-317 ***Lab Sample ID:*** **042219669-0107**

Sample Description: Elevator Area, Level 1/White w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-319 ***Lab Sample ID:*** **042219669-0108**

Sample Description: Elevator Area, Level 1/White w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-321 ***Lab Sample ID:*** **042219669-0109**

Sample Description: Elevator Area, Level 1/White w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-318 ***Lab Sample ID:*** **042219669-0110**

Sample Description: Elevator Area, Level 1/Mastic associated w/M-105

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-320 ***Lab Sample ID:*** **042219669-0111**

Sample Description: Elevator Area, Level 1/Mastic associated w/M-105

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-322 ***Lab Sample ID:*** **042219669-0112**

Sample Description: Elevator Area, Level 1/Mastic associated w/M-105

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-323 ***Lab Sample ID:*** **042219669-0113**

Sample Description: Elevator Area, Level 1/Dark Blue w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-325 ***Lab Sample ID:*** **042219669-0114**

Sample Description: Elevator Area, Level 1/Dark Blue w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	

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Client Sample ID: GIS-327 ***Lab Sample ID:*** **042219669-0115**

Sample Description: Elevator Area, Level 1/Dark Blue w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-324 ***Lab Sample ID:*** **042219669-0116**

Sample Description: Elevator Area, Level 1/Mastic associated w/M-107

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-326 ***Lab Sample ID:*** **042219669-0117**

Sample Description: Elevator Area, Level 1/Mastic associated w/M-107

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-328 ***Lab Sample ID:*** **042219669-0118**

Sample Description: Elevator Area, Level 1/Mastic associated w/M-107

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-329 ***Lab Sample ID:*** **042219669-0119**

Sample Description: South Stairwell Room 105 and 109/Plaster White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-331 ***Lab Sample ID:*** **042219669-0120**

Sample Description: South Stairwell Room 105 and 109/Plaster White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-333 ***Lab Sample ID:*** **042219669-0121**

Sample Description: South Stairwell Room 105 and 109/Plaster White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-330 ***Lab Sample ID:*** **042219669-0122**

Sample Description: South Stairwell Room 105 and 109/Plaster Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown	10.0%	90.0%	None Detected	

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Client Sample ID: GIS-332 ***Lab Sample ID:*** **042219669-0123**
Sample Description: South Stairwell Room 105 and 109/Plaster Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown	0.0%	100.0%	None Detected	The sample group is not homogeneous

Client Sample ID: GIS-334 ***Lab Sample ID:*** **042219669-0124**
Sample Description: South Stairwell Room 105 and 109/Plaster Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GIS-335 ***Lab Sample ID:*** **042219669-0125**
Sample Description: Room 105 Main Office and Room 109/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: GIS-336 ***Lab Sample ID:*** **042219669-0126**
Sample Description: Room 105 Main Office and Room 109/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-337 ***Lab Sample ID:*** **042219669-0127**
Sample Description: Room 105 Main Office and Room 109/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: GIS-338 ***Lab Sample ID:*** **042219669-0128**
Sample Description: Nurse Room 106/12"X12" Pink Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Pink	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Pink	0.0%	100.0%	None Detected	

Client Sample ID: GIS-340 ***Lab Sample ID:*** **042219669-0129**
Sample Description: Nurse Room 106/12"X12" Pink Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Pink	0.0%	100%	None Detected	

Client Sample ID: GIS-342 ***Lab Sample ID:*** **042219669-0130**
Sample Description: Nurse Room 106/12"X12" Pink Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Pink	0.0%	100%	None Detected	

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Client Sample ID: GIS-339 ***Lab Sample ID:*** **042219669-0131**

Sample Description: Nurse Room 106/Mastic associated w/M-112

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-341 ***Lab Sample ID:*** **042219669-0132**

Sample Description: Nurse Room 106/Mastic associated w/M-112

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-343 ***Lab Sample ID:*** **042219669-0133**

Sample Description: Nurse Room 106/Mastic associated w/M-112

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-344 ***Lab Sample ID:*** **042219669-0134**

Sample Description: Nurse Room 106/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-345 ***Lab Sample ID:*** **042219669-0135**

Sample Description: Nurse Room 106/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-346 ***Lab Sample ID:*** **042219669-0136**

Sample Description: Nurse Room 106/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-347 ***Lab Sample ID:*** **042219669-0137**

Sample Description: Nurse Room 106/Light Green Floor Tile with White Specks 12"x12"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-349 ***Lab Sample ID:*** **042219669-0138**

Sample Description: Nurse Room 106/Light Green Floor Tile with White Specks 12"x12"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	

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Client Sample ID: GIS-351 ***Lab Sample ID:*** **042219669-0139**

Sample Description: Nurse Room 106/Light Green Floor Tile with White Specks 12"x12"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-348 ***Lab Sample ID:*** **042219669-0140**

Sample Description: Nurse Room 106/Mastic assocaited w/M-115

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-350 ***Lab Sample ID:*** **042219669-0141**

Sample Description: Nurse Room 106/Mastic assocaited w/M-115

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-352 ***Lab Sample ID:*** **042219669-0142**

Sample Description: Nurse Room 106/Mastic assocaited w/M-115

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-353 ***Lab Sample ID:*** **042219669-0143**

Sample Description: Nurse Room 106/White 12"x12" Floor Tile w/Green Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	White/Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	White/Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-355 ***Lab Sample ID:*** **042219669-0144**

Sample Description: Nurse Room 106/White 12"x12" Floor Tile w/Green Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	White/Green	0.0%	100%	None Detected	

Client Sample ID: GIS-357 ***Lab Sample ID:*** **042219669-0145**

Sample Description: Nurse Room 106/White 12"x12" Floor Tile w/Green Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	White/Green	0.0%	100%	None Detected	

Client Sample ID: GIS-354 ***Lab Sample ID:*** **042219669-0146**

Sample Description: Nurse Room 106/Mastic associated w/M-117

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-356 ***Lab Sample ID:*** **042219669-0147**
Sample Description: Nurse Room 106/Mastic associated w/M-117

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-358 ***Lab Sample ID:*** **042219669-0148**
Sample Description: Nurse Room 106/Mastic associated w/M-117

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-359 ***Lab Sample ID:*** **042219669-0149**
Sample Description: South Staircase Room 103 and Near Elevator/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-360 ***Lab Sample ID:*** **042219669-0150**
Sample Description: South Staircase Room 103 and Near Elevator/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-361 ***Lab Sample ID:*** **042219669-0151**
Sample Description: South Staircase Room 103 and Near Elevator/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-362 ***Lab Sample ID:*** **042219669-0152**
Sample Description: Room 103/Carpet Mastic Dark Yellow

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	99.1%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-363 ***Lab Sample ID:*** **042219669-0153**
Sample Description: Room 103/Carpet Mastic Dark Yellow

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	99.0%	None Detected	

Client Sample ID: GIS-364 ***Lab Sample ID:*** **042219669-0154**
Sample Description: Room 103/Carpet Mastic Dark Yellow

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	99.6%	None Detected	

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Client Sample ID: GIS-365 ***Lab Sample ID:*** **042219669-0155**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-366 ***Lab Sample ID:*** **042219669-0156**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-367 ***Lab Sample ID:*** **042219669-0157**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-368 ***Lab Sample ID:*** **042219669-0158**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-369 ***Lab Sample ID:*** **042219669-0159**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-370 ***Lab Sample ID:*** **042219669-0160**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown/White	30.0%	70.0%	None Detected	

Client Sample ID: GIS-371 ***Lab Sample ID:*** **042219669-0161**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-372 ***Lab Sample ID:*** **042219669-0162**
Sample Description: Café/Beige 12"x12" Speckled Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-374 ***Lab Sample ID:*** **042219669-0163**

Sample Description: Café/Beige 12"x12" Speckled Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-376 ***Lab Sample ID:*** **042219669-0164**

Sample Description: Café/Beige 12"x12" Speckled Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-373 ***Lab Sample ID:*** **042219669-0165**

Sample Description: Café/Mastic associated w/M-122

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-375 ***Lab Sample ID:*** **042219669-0166**

Sample Description: Café/Mastic associated w/M-122

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-377 ***Lab Sample ID:*** **042219669-0167**

Sample Description: Café/Mastic associated w/M-122

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-378 ***Lab Sample ID:*** **042219669-0168**

Sample Description: Café/Red 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-380 ***Lab Sample ID:*** **042219669-0169**

Sample Description: Café/Red 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-382 ***Lab Sample ID:*** **042219669-0170**

Sample Description: Café/Red 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

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Client Sample ID: GIS-379 ***Lab Sample ID:*** **042219669-0171**

Sample Description: Café/Mastic associated w/M-124

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-381 ***Lab Sample ID:*** **042219669-0172**

Sample Description: Café/Mastic associated w/M-124

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-383 ***Lab Sample ID:*** **042219669-0173**

Sample Description: Café/Mastic associated w/M-124

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-384 ***Lab Sample ID:*** **042219669-0174**

Sample Description: Café/Green 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-386 ***Lab Sample ID:*** **042219669-0175**

Sample Description: Café/Green 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-388 ***Lab Sample ID:*** **042219669-0176**

Sample Description: Café/Green 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-385 ***Lab Sample ID:*** **042219669-0177**

Sample Description: Café/Mastic assocaited w/M-126

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-387 ***Lab Sample ID:*** **042219669-0178**

Sample Description: Café/Mastic assocaited w/M-126

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

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Client Sample ID: GIS-389 ***Lab Sample ID:*** **042219669-0179**

Sample Description: Café/Mastic assocaited w/M-126

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-390 ***Lab Sample ID:*** **042219669-0180**

Sample Description: Café/Blue 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-392 ***Lab Sample ID:*** **042219669-0181**

Sample Description: Café/Blue 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-394 ***Lab Sample ID:*** **042219669-0182**

Sample Description: Café/Blue 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-391 ***Lab Sample ID:*** **042219669-0183**

Sample Description: Café/Mastic associated w/ M-128

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-393 ***Lab Sample ID:*** **042219669-0184**

Sample Description: Café/Mastic associated w/ M-128

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-395 ***Lab Sample ID:*** **042219669-0185**

Sample Description: Café/Mastic associated w/ M-128

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-396-Baseboard ***Lab Sample ID:*** **042219669-0186**

Sample Description: Café/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-396-Mastic ***Lab Sample ID:*** **042219669-0186A**

Sample Description: Café/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-397-Baseboard ***Lab Sample ID:*** **042219669-0187**

Sample Description: Café/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-397-Mastic ***Lab Sample ID:*** **042219669-0187A**

Sample Description: Café/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-398-Baseboard ***Lab Sample ID:*** **042219669-0188**

Sample Description: Café/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-398-Mastic ***Lab Sample ID:*** **042219669-0188A**

Sample Description: Café/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-399-Baseboard ***Lab Sample ID:*** **042219669-0189**

Sample Description: Café Hallway/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-399-Mastic ***Lab Sample ID:*** **042219669-0189A**

Sample Description: Café Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-400-Baseboard ***Lab Sample ID:*** **042219669-0190**

Sample Description: Café Hallway/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

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Client Sample ID: GIS-400-Mastic **Lab Sample ID:** **042219669-0190A**
Sample Description: Café Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-401-Baseboard **Lab Sample ID:** **042219669-0191**
Sample Description: Café Hallway/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-401-Mastic **Lab Sample ID:** **042219669-0191A**
Sample Description: Café Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-402 **Lab Sample ID:** **042219669-0192**
Sample Description: Back Entrance Ramp/Teal 12"x12" Linoleum Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-404 **Lab Sample ID:** **042219669-0193**
Sample Description: Back Entrance Ramp/Teal 12"x12" Linoleum Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-406 **Lab Sample ID:** **042219669-0194**
Sample Description: Back Entrance Ramp/Teal 12"x12" Linoleum Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-403 **Lab Sample ID:** **042219669-0195**
Sample Description: Back Entrance Ramp/Mastic assocaited w/M-132

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022				Insufficient Material	

Client Sample ID: GIS-405 **Lab Sample ID:** **042219669-0196**
Sample Description: Back Entrance Ramp/Mastic assocaited w/M-132

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-407 ***Lab Sample ID:*** **042219669-0197**

Sample Description: Back Entrance Ramp/Mastic assocaited w/M-132

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-408 ***Lab Sample ID:*** **042219669-0198**

Sample Description: Back Entrance/White w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-410 ***Lab Sample ID:*** **042219669-0199**

Sample Description: Back Entrance/White w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-412 ***Lab Sample ID:*** **042219669-0200**

Sample Description: Back Entrance/White w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-409 ***Lab Sample ID:*** **042219669-0201**

Sample Description: Back Entrance/Mastic associated w/M-134

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-411 ***Lab Sample ID:*** **042219669-0202**

Sample Description: Back Entrance/Mastic associated w/M-134

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-413 ***Lab Sample ID:*** **042219669-0203**

Sample Description: Back Entrance/Mastic associated w/M-134

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-414 ***Lab Sample ID:*** **042219669-0204**

Sample Description: Café Hallway/White 2'x2' Pinhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	75.0%	25.0%	None Detected	

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Client Sample ID: GIS-415 ***Lab Sample ID:*** **042219669-0205**
Sample Description: Café Hallway/White 2'x2' Pinhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	75.0%	25.0%	None Detected	

Client Sample ID: GIS-416 ***Lab Sample ID:*** **042219669-0206**
Sample Description: Café Hallway/White 2'x2' Pinhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	75.0%	25.0%	None Detected	

Client Sample ID: GIS-417 ***Lab Sample ID:*** **042219669-0207**
Sample Description: Café Hallway/White 2x4' Pinhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	75.0%	25.0%	None Detected	

Client Sample ID: GIS-418 ***Lab Sample ID:*** **042219669-0208**
Sample Description: Café Hallway/White 2x4' Pinhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-419 ***Lab Sample ID:*** **042219669-0209**
Sample Description: Café Hallway/White 2x4' Pinhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	75.0%	25.0%	None Detected	

Client Sample ID: GIS-420 ***Lab Sample ID:*** **042219669-0210**
Sample Description: Room 100/Mastic for Carpet

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Tan	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Tan	0.0%	100.0%	None Detected	

Client Sample ID: GIS-421 ***Lab Sample ID:*** **042219669-0211**
Sample Description: Room 100/Mastic for Carpet

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-422 ***Lab Sample ID:*** **042219669-0212**
Sample Description: Room 100/Mastic for Carpet

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Tan	0.0%	100%	None Detected	

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Client Sample ID: GIS-423 ***Lab Sample ID:*** **042219669-0213**

Sample Description: Basement by Street/Boiler Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	15.0%	85.0%	None Detected	

Client Sample ID: GIS-424 ***Lab Sample ID:*** **042219669-0214**

Sample Description: Basement by Street/Boiler Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	20.0%	80.0%	None Detected	

Client Sample ID: GIS-425 ***Lab Sample ID:*** **042219669-0215**

Sample Description: Basement by Street/Boiler Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray	40.0%	60.0%	None Detected	

Client Sample ID: GIS-426 ***Lab Sample ID:*** **042219669-0216**

Sample Description: Basement by Street/Boiler Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	20.0%	80.0%	None Detected	

Client Sample ID: GIS-427 ***Lab Sample ID:*** **042219669-0217**

Sample Description: Basement by Street/Boiler Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	20.0%	80.0%	None Detected	

Client Sample ID: GIS-428 ***Lab Sample ID:*** **042219669-0218**

Sample Description: Basement by Street/Boiler Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray	35.0%	65.0%	None Detected	

Client Sample ID: GIS-429 ***Lab Sample ID:*** **042219669-0219**

Sample Description: Basement by Street/Red Boiler Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-430 ***Lab Sample ID:*** **042219669-0220**

Sample Description: Basement by Street/Red Boiler Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

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Client Sample ID: GIS-431 ***Lab Sample ID:*** **042219669-0221**
Sample Description: Basement by Street/Red Boiler Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-432 ***Lab Sample ID:*** **042219669-0222**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	25.0%	75.0%	None Detected	

Client Sample ID: GIS-433 ***Lab Sample ID:*** **042219669-0223**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	25.0%	75.0%	None Detected	

Client Sample ID: GIS-434 ***Lab Sample ID:*** **042219669-0224**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	30.0%	70.0%	None Detected	

Client Sample ID: GIS-435 ***Lab Sample ID:*** **042219669-0225**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	30.0%	70.0%	None Detected	

Client Sample ID: GIS-436 ***Lab Sample ID:*** **042219669-0226**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	30.0%	70.0%	None Detected	

Client Sample ID: GIS-437 ***Lab Sample ID:*** **042219669-0227**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray	30.0%	70.0%	None Detected	

Client Sample ID: GIS-438 ***Lab Sample ID:*** **042219669-0228**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray	30.0%	70.0%	None Detected	

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Client Sample ID: GIS-439 ***Lab Sample ID:*** **042219669-0229**

Sample Description: Basement 1st Room on Right/Brown 9"x9" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Brown	0.0%	97.0%	**3.0% Chrysotile**	

Client Sample ID: GIS-441 ***Lab Sample ID:*** **042219669-0230**

Sample Description: Basement 1st Room on Right/Brown 9"x9" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Brown	0.0%	97.0%	**3.0% Chrysotile**	

Client Sample ID: GIS-443 ***Lab Sample ID:*** **042219669-0231**

Sample Description: Basement 1st Room on Right/Brown 9"x9" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Brown	0.0%	95.6%	**4.4% Chrysotile**	

Client Sample ID: GIS-440 ***Lab Sample ID:*** **042219669-0232**

Sample Description: Basement 1st Room on Right/Mastic associated w/M-143

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black/Yellow	0.0%	100%	**<0.25% Chrysotile**	
TEM Grav. Reduction	8/21/2022	Black/Yellow	0.00%	99.59%	**0.41% Chrysotile**	

Client Sample ID: GIS-442 ***Lab Sample ID:*** **042219669-0233**

Sample Description: Basement 1st Room on Right/Mastic associated w/M-143

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black/Yellow	0.0%	99.6%	**0.40% Chrysotile**	

Client Sample ID: GIS-444 ***Lab Sample ID:*** **042219669-0234**

Sample Description: Basement 1st Room on Right/Mastic associated w/M-143

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black/Yellow	0.0%	99.6%	**0.37% Chrysotile**	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-445 ***Lab Sample ID:*** **042219669-0235**

Sample Description: Emergency Fire Exit/Fire Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-446 ***Lab Sample ID:*** **042219669-0236**

Sample Description: Emergency Fire Exit/Fire Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order ID:	042219669
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	

Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-447 ***Lab Sample ID:*** **042219669-0237**

Sample Description: Emergency Fire Exit/Fire Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-448 ***Lab Sample ID:*** **042219669-0238**

Sample Description: Crawlspace in Back Street Basement/Debris from Crawl Space

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown	5.0%	95.0%	None Detected	

Client Sample ID: GIS-449 ***Lab Sample ID:*** **042219669-0239**

Sample Description: Crawlspace in Back Street Basement/Debris from Crawl Space

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown	5.0%	95.0%	None Detected	

Client Sample ID: GIS-450 ***Lab Sample ID:*** **042219669-0240**

Sample Description: Crawlspace in Back Street Basement/Debris from Crawl Space

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown	0.0%	100.0%	None Detected	

Analyst(s):

Andrea Doughty	PLM (53) PLM Grav. Reduction (73)
Daniel Blake	TEM Grav. Reduction (62)
John Witcraft	PLM (12)
Julianna Hosbach	PLM Grav. Reduction (99)
Laura Kantor	PLM (13) PLM Grav. Reduction (12)

Reviewed and approved by:

Samantha Rundstrom, Laboratory Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. This test report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. EMSL bears no responsibility for sample collection activities or analytical method limitations. The laboratory is not responsible for the accuracy of results when requested to physically separate and analyze layered samples. PLM alone is not consistently reliable in detecting asbestos in floor coverings and similar NOBs

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ PA ID# 68-00367, NVLAP Lab Code 101048-0

Initial report from: 08/22/202209:48:33

OrderID: 042219669

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Asbestos Chain of Custody

EMSL Order Number *(Lab Use Only)*: 042219669

EMSL ANALYTICAL, INC.
200 ROUTE 130 N
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5973

Company : PARS Environmental	**EMSL-Bill to:** ☒ Same ☐ Different If Bill to is Different note instructions in Comments** *Third Party Billing requires written authorization from third party*
Street: 500 Horizon Drive, Suite 540	
City: Robbinsville / **State/Province: NJ**	**Zip/Postal Code: 08691** / **Country: USA**
Report To (Name): Julian Fernandez-Obregon	**Fax #: 609-890-9116**
Telephone #: 609-890-7277	**Email Address: jfernandez@montrose-env.com**
Project Name/Number: Glassboro Intermediate School	
Please Provide Results: ☐ Fax ☒ Email	**Purchase Order: 1200-42** / **U.S. State Samples Taken: NJ**

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☒ 1 Week ☐ 2 Week

**For TEM Air 3 hr through 6 hr, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air
- ☐ NIOSH 7400
- ☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
- ☒ PLM EPA 600/R-93/116 (<1%)
- ☒ PLM EPA NOB (<1%)

Point Count
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)

Point Count w/Gravimetric
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- ☐ NYS 198.1 (friable in NY)
- ☐ NYS 198.6 NOB (non-friable-NY)
- ☐ NIOSH 9002 (<1%)

TEM – Air ☐ **4-4.5hr TAT (AHERA only)**
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312

TEM - Bulk
- ☒ TEM EPA NOB
- ☐ NYS NOB 198.4 (non-friable-NY)
- ☐ Chatfield SOP
- ☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2
- Fibers >10µm ☐ Waste ☐ Drinking
- All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
- ☐ Microvac - ASTM D 5755
- ☐ Wipe - ASTM D6480
- ☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
- ☐ PLM CARB 435 - A (0.25% sensitivity)
- ☐ PLM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - C (0.01% sensitivity)
- ☐ EPA Protocol (Semi-Quantitative)
- ☐ EPA Protocol (Quantitative)

Other:
- ☐

☐ **Check For Positive Stop – Clearly Identify Homogenous Group**

Samplers Name: Marissa Weinstein | **Samplers Signature:** Marissa Weinstein

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
	See Attached		

Client Sample # (s): - **Total # of Samples:** ~~239~~ 240

Relinquished (Client): Marissa Weinstein **Date:** 8/9/2022 **Time:**

Received (Lab): [illegible] **Date:** 8/9/22 **Time:** 330

Comments/Special Instructions:

042219669

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location GIS Page: 2

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-71	Dark blue stair tread	GIS-211 GIS-212 GIS-213	South Stairs	500 SF	D	
M-72	Dark blue 12x12 in floor tile	GIS-214 GIS-216 GIS-218	1st level by Room 114	451 SF	D	
M-73	Mastic associated with M-72	GIS-215 GIS-217 GIS-219	1st level by Room 114	451 SF	D	
M-74	White with Gray specks 12x12 floor tile	GIS-220 GIS-222 GIS-224	1st level by Room 114	451 SF	D	
M-75	Mastic associated with M-74	GIS-221 GIS-223 GIS-225	1st level by Room 114	451 SF	D	
M-76	Red baseboard and mastic	GIS-226 GIS-227 GIS-228	Room 114	200 SF	D	
M-77	Blue baseboard and Mastic	GIS-229 GIS-230 GIS-231	Hallway outside library, Library	200 SF	D	
M-78	Carpet Mastic	GIS-232 GIS-233 GIS-234	Library and Room 114	5500 SF	D	
S-79	Plaster - White	GIS-235 GIS-237 GIS-239	Library, Hallway outside Library, closet across 114	3000 SF	D	
S-80	Plaster - Brown	GIS-236 GIS-238 GIS-240	Library, Hallway outside Library, closet across 114	3000 SF	D	

Signature: Date Sampled: 7/29/22 PARS Project #: 1200-42

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Sampling Technician: MW Site Location GIS Page: 3

0422196669

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-81	Drywall	GIS-241 GIS-242 GIS-243	Inside storage near 116 116 and, 114	1000 SF	D	
M-82	Pinhole white 2x4' ceiling tile	GIS-244 GIS-245 GIS-246	Hallway outside library	500 SF	D	
M-83	Pinhole with small circular crater white 2x4' ceiling tile	GIS-247 GIS-248 GIS-249	Inside storage near 116, Hall outside storage outside 114	200 SF	D	
T-84	Spray-on insulation	GIS-250 GIS-251 GIS-252 GIS-253 GIS-254 GIS-255 GIS-256	Inside both maintenance closets in library hallway	200 SF	D	
M-85	Black window ledge	GIS-257 GIS-258 GIS-259	Corridor before gym north + South	20 SF	D	
M-86	Tan 12x12 in floor tile with colored specks	GIS-260 GIS-262 GIS-264	Office 110 in boys locker Room and Office 111 in girls locker room	300 SF	D	
M-87	Mastic associated w/ M-86	GIS-261 GIS-263 GIS-265	Office 110 and 111	300 SF	D	
M-88	Joint Compound	GIS-266 GIS-267 GIS-268	Room 114, across 114, across storage near 116	100 SF	D	
S-89	Plaster - White	GIS-269 GIS-271 GIS-273	North stairwell area	1000 SF	D	
S-90	Plaster - Brown	GIS-270 GIS-272 GIS-274	North stairwell area	1000 SF	D	

Signature: Marin West Date Sampled: 7/29/2022 PARS Project #: 1200-42

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Sampling Technician: MW Site Location GIS Page: 4

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-91	Red 12x12" floor tile	GIS-275 GIS-277 GIS-277	Room 109	614 SF	D	
M-92	Mastic associated w/ M-91	GIS-276 GIS-278 GIS-280	Room 109	614 SF	D	
M-93	Red Baseboard & Mastic	GIS-281 GIS-282 GIS-283	Room 109	200 SF	D	
M-94	Dark Green floor tile with colored specks 12x12"	GIS-284 GIS-286 GIS-288	Room 107	641 SF	D	
M-95	Mastic associated w/ M-94	GIS-285 GIS-287 GIS-289	Room 107	641 SF	D	
M-96	Green baseboard and mastic	GIS-290 GIS-291 GIS-292	Room 107	200 SF	D	
M-97	Black baseboard and Mastic	GIS-293 GIS-294 GIS-295	By stairways	100 SF	D	
M-98	Light green tile with white specks	GIS-296 GIS-298 GIS-300	Room 110-1, Principals office, and staff lounge	1200 SF	D	
M-99	Mastic associated with M-98	GIS-297 GIS-299 GIS-301	Room 110-1, Principals office, and staff lounge	1200 SF	D	
M-100	Burgandy baseboard and mastic	GIS-302 GIS-303 GIS-304	Main office	200 SF	D	

Signature: Marin West Date Sampled: 7/29/2022 PARS Project #: 1200-42

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Sampling Technician: MW Site Location GIS Page: 5

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-101	12"x12" Tan w/ Colored Specks Floor Tile	GIS-305 GIS-307 GIS-309	Rooms 109, 107, and 105	2200 SF	D	
M-102	Mastic Associated w/M-101	GIS-306 GIS-308 GIS-310	Rooms 109, 107, and 105	2200 SF	D	
M-103	Yellow Carpet Mastic	GIS-311 GIS-312 GIS-313	main office	917 SF	D	
M-104	Pinhole 2'x4' Ceiling Tile White	GIS-314 GIS-315 GIS-316	North Stairwell, South Stairwell, Room 107	3000 SF	D	
M-105	White w/ Specks 12"x12" Floor Tile	GIS-317 GIS-319 GIS-321	Elevator Area, Level 1	130 SF	D	
M-106	Mastic Associated w/ M-105	GIS-318 GIS-320 GIS-322	Elevator Area, Level 1	130 SF	D	
M-107	Dark Blue w/ Specks 12"x 12" Floor Tile	GIS-323 GIS-325 GIS-327	Elevator Area Level 1	130 SF	D	
M-108	Mastic Associated w/ M-107	GIS-324 GIS-326 GIS-328	Elevator Area, Level 1	130 SF	D	
S-109	Plaster-White	GIS-329 GIS-331 GIS-333	South Stairwell, Room 105 and 109	3000 SF	D	
S-110	Plaster - Brown	GIS-330 GIS-332 GIS-334	South Stairwell, Room 105 and 109	3000 SF	D	

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Signature: Marni Wentz Date Sampled: 7/29/2022 PARS Project #: 1200-42

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HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-111	Dry Wall	GIS-335 GIS-336 GIS-337	Room 105 Main office and Room 109	1000 SF	D	
M-112	12"x12" Pink Floor Tile	GIS-338 GIS-340 GIS-342	Nurse Room 106	768 SF	D	
M-113	Mastic Associated W/ M-112	GIS-339 GIS-341 GIS-343	Nurse Room 106	768 SF	D	
M-114	Black Sink undercoating	GIS-344 GIS-345 GIS-346	Nurse 106	5 SF	D	
M-115	Light green floor tile with white specks 12" x 12"	GIS-347 GIS-349 GIS-351	Nurse 106	768 SF	D	
M-116	Mastic Associated with M-115	GIS-348 GIS-350 GIS-352	Nurse 106	768 SF	D	
M-117	White 12"x12" floor tile with green specks	GIS-353 GIS-355 GIS-357	Nurse 106	768 SF	D	
M-118	Mastic Associated with M-117	GIS-354 GIS-356 GIS-358	Nurse 106	768 SF	D	
M-119	Joint compound	GIS-359 GIS-360 GIS-361	South stair case, Room 103, and near elevator	1000 SF	D	
M-120	carpet Mastic dark yellow	GIS-362 GIS-363 GIS-364	Room 103	SF	D	

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Signature: Marina Wurst Date Sampled: 7/29/2022 PARS Project #: 1200-42

OrderID: 042219669

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Sampling Technician: MW Site Location GIS Page: 7

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
S-121	Spray Insulation White	GIS-365, 366, 367 GIS-368, 369, 370, 371	Room 103 Ceiling	1246 SF	D	
m-122	Beige 12"x12" speckled Floor Tile	GIS-372 GIS-374 GIS-376	Cafe	700 SF	D	
m-123	mastic Associated w/ m-122	GIS-373 GIS-375 GIS-377	Cafe	706 SF	D	
m-124	Red 12"x12" Floor Tile	GIS-378 GIS-380 GIS-382	Cafe	20 SF	D	
m-125	mastic Associated w/ m-124	GIS-379 GIS-381 GIS-383	Cafe	20 SF	D	
m-126	Green 12"x12" Floor Tile	GIS-384 GIS-386 GIS-388	Cafe	20 SF	D	
m-127	mastic Associated w/ m-126	GIS-385 GIS-387 GIS-389	Cafe	20 SF	D	
m-128	Blue 12"x12" Floor Tile	GIS-390 GIS-392 GIS-394	Cafe	20 SF	D	
m-129	mastic Associated w/ m-128	GIS-391 GIS-393 GIS-395	Cafe	20 SF	D	
m-130	Blue Baseboard w/ mastic	GIS-396 GIS-397 GIS-398	Cafe	59 SF	D	

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OrderID: 042219669

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Sampling Technician: MW Site Location GIS Page: 8

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-131	Blue Base board and mastic	GIS-399 GIS-400 GIS-401	Cafe hallway	700 SF	D	
M-132	Teal 12" x12" Linoleum Floor tile	GIS-402 GIS-404 GIS-406	Back entrance Ramp	251 SF	D	
M-133	Mastic Associated W/ M-132	GIS-403 GIS-405 GIS-407	Back entrance Ramp	251 SF	D	
M-134	white w/specks 12"x12" Floor tile	GIS-408 GIS-410 GIS-412	Back entrance	95 SF	D	
M-135	Mastic Associated W/ M-134	GIS-409 GIS-411 GIS-413	Back entrance	95 SF	D	
M-136	White 2x2' Pinhole Ceiling tile	GIS-414 GIS-415 GIS-416	Cafe hallway	751 SF	D	
M-137	White 2x4' Pinhole ceiling tile	GIS-417 GIS-418 GIS-419	Cafe hallway	751 SF	D	
M-138	Mastic For Carpet, Fun	GIS-420 GIS-421 GIS-422	Room 100	1372 SF	D	
M-139	Boiler insulation Gray	GIS-423 GIS-424 GIS-425	Basement by Street	100 SF	D	
M-140	Boiler insulation Gray 2	GIS-426 GIS-427 GIS-428	Basement Street	100	D	

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PARS Environmental, Inc. 042219669 **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location GIS Page: 9

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
m-141	Red Boiler Caulk	GIS-429 GIS-430 GIS-431	Basement by Street	2SF	D	
S-142	Gray Spray-on Insulation	GIS-432, 433, 434 GIS-435, 436, 437, 438	Basement by Back-street	241 SF	D	
m-143	Brown 9"x9" Floor Tile	GIS-439 GIS-441 GIS-443	Basement (1st Room on Right)	494 SF	D	
m-144	Mastic Associated w/ m-143	GIS-440 GIS-442 GIS-444	Basement (1st Room on Right)	494 SF	D	
m-145	Fire Caulk	GIS-445 GIS-446 GIS-447.	Emergency Fire Exit	2SF	D	
m-146	Debris from crawlspace	GIS-448 GIS-449 GIS-450	Crawlspace in Back-street basement	100 SF	D	

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OrderID: 202207061

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EMSL Order ID *(Lab Use Only)*: 202207061

EMSL ANALYTICAL, INC.
200 ROUTE 130 N
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5973

Company : PARS Environmental		**EMSL-Bill to:** ☒ Same ☐ Different If Bill to is Different note instructions in Comments**	
Street: 500 Horizon Drive, Suite 540		*Third Party Billing requires written authorization from third party*	
City: Robbinsville	**State/Province: NJ**	**Zip/Postal Code: 08691**	**Country: USA**
Report To (Name): Julian Fernandez-Obregon		**Fax #: 609-890-9116**	
Telephone #: 609-890-7277		**Email Address: jfernandez@montrose-env.com**	
Project Name/Number: Rowan - GIS			
Please Provide Results: ☐ Fax ☒ Email	**Purchase Order: 1200-42**	**U.S. State Samples Taken: NJ**	

Turnaround Time (TAT) Options* - Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☒ 1 Week ☐ 2 Week

**Analysis completed in accordance with EMSL's Terms and Conditions located in the Price Guide*

Matrix	Method	Instrument	Reporting Limit	Check
Chips ☐ mg/cm² ☒ % by wt.	SW846-7000B/7420 or AOAC 974.02	Flame Atomic Absorption	0.01%	☒
Air	NIOSH 7082	Flame Atomic Absorption	4 µg/filter	☐
	NIOSH 7105	Graphite Furnace AA	0.03 µg/filter	☐
	NIOSH 7300 modified	ICP-AES	0.5 µg/filter	☐
Wipe* ☐ ASTM ☐ non ASTM *if no box is checked, non-ASTM Wipe is assumed	SW846-7000B/7420	Flame Atomic Absorption	10 µg/wipe	☐
	SW846-6010B or C	ICP-AES	0.5 µg/wipe	☐
TCLP	SW846-1311/7420/SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	SW846-6010B or C	ICP-AES	0.1 mg/L (ppm)	☐
Soil	SW846-7000B/7420	Flame Atomic Absorption	40 mg/kg (ppm)	☐
	SW846-7421	Graphite Furnace AA	0.3 mg/kg (ppm)	☐
	SW846-6010B or C	ICP-AES	1 mg/kg (ppm)	☐
Wastewater	SM3111B or SW846-7000B/7420	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)	☐
	SW846-6010B or C	ICP-AES	1 mg/kg (ppm)	☐
Drinking Water	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)	☐

Other:	**Preservation Method (Water):**
Name of Sampler: Marissa Weinstein	**Signature of Sampler:** Marissa Weinstein

Sample #	Location	Volume/Area	Date/Time Sampled
GISL-1	3rd FL Hall Beige Window Sills	N/A	7/28/2022
GISL-2	3rd FL Hall Gray Baseboard	N/A	7/28/2022
GISL-3	310 Beige Wall	N/A	7/28/2022
GISL-4	North Stairwell Beige Wall	N/A	7/28/2022
GISL-5	305 Beige Wall	N/A	7/28/2022
GISL-6	306 Beige Bay Window	N/A	7/28/2022

Client Sample #'s	-			**Total # of Samples:**	32
Relinquished (Client):	Marissa Weinstein	**Date:**	8/10/2022	**Time:**	
Received (Lab):	WI	**Date:**	8/10/22	**Time:**	3:10
Comments:					

OrderID: 202207061

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LEAD (Pb) CHAIN OF CUSTODY

EMSL ORDER ID *(Lab Use Only):*

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EMSL ANALYTICAL
200 ROUTE 130 N
CINNAMINSON, NJ
PHONE: (800) 220-3675
FAX: (856) 786-5973

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Location	Volume/Area	Date/Time Sampled
GISL-7	304 Beige Window	N/A	7/28/2022
GISL-8	303 Beige Window Sill	N/A	7/28/2022
GISL-9	217 Beige Wall	N/A	7/28/2022
GISL-10	219 Beige Wood Trim	N/A	7/28/2022
GISL-11	2nd FL North Hall Beige Wall	N/A	7/28/2022
GISL-12	215 Aqua Door	N/A	7/28/2022
GISL-13	North Hall Stairwell Beige Wall	N/A	7/28/2022
GISL-14	200 Beige Window Sill	N/A	7/28/2022
GISL-15	Exterior Door #01 White	N/A	7/28/2022
GISL-16	116 Hall Beige Wall	N/A	7/28/2022
GISL-17	Library 112 Beige Wall	N/A	7/29/2022
GISL-18	Hallway by 112 Mustard Beige Wall	N/A	7/29/2022
GISL-19	109 Beige Wall	N/A	7/29/2022
GISL-20	110-3 Beige Ceiling not recieved/ 8/15/22 Rec'd 10am.	N/A	7/29/2022
GISL-21	Staff Dining 105 Beige Wall	N/A	7/29/2022
GISL-22	Cafeteria 104 Beige Wall	N/A	7/29/2022
GISL-23	Hallway by 103 Gray Floor	N/A	7/29/2022
GISL-24	Hallway by 106 Beige Wall	N/A	7/29/2022

Comments/Special Instructions:

Controlled Document — Lead (Pb) COC – R2– 1/12/2010

Page 2 Of 3

EMSL ANALYTICAL, INC.
LABORATORY - PRODUCTS - TRAINING

LEAD (Pb) CHAIN OF CUSTODY

EMSL ORDER ID *(Lab Use Only):*

202207061

EMSL ANALYTICAL
200 ROUTE 130 N
CINNAMINSON, NJ
PHONE: (800) 220-3675
FAX: (856) 786-5973

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Location	Volume/Area	Date/Time Sampled
GISL-25	Kitchen White Wall	N/A	7/29/2022
GISL-26	Hallway by 100	N/A	7/29/2022
GISL-27	Basement by Back-Street Gray Floor	N/A	7/29/2022
GISL-28	Basement by Back-Street Green Wall	N/A	7/29/2022
GISL-29	Basement by Back-Street Hallway White Wall	N/A	7/29/2022
GISL-30	Basement by Back-Street Gray Baseboard	N/A	7/29/2022
GISL-31	Basement by Street White Door	N/A	7/29/2022
GISL-32	Basement by Street Red Door	N/A	7/29/2022

Comments/Special Instructions:

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.EMSL.com cinnaminsonleadlab@emsl.com

EMSL Order:	202207061
CustomerID:	PARS51
CustomerPO:	1200-42
ProjectID:	

Attn: **Julian Fernandez-Obregon**
PARS Environmental
500 Horizon Drive
Suite 540
Robbinsville, NJ 08691

Phone:	(609) 890-7277
Fax:	(609) 890-9116
Received:	8/15/2022 10:00 AM
Collected:	7/28/2022

Project: **ROWAN - GIS**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Weight*	*Lead Concentration*
GISL-1	*202207061-0001*	7/28/2022	8/17/2022	0.2835 g	0.012 % wt
	Site: 3RD FL HALL BEIGE WINDOW SILLS				
GISL-2	*202207061-0002*	7/28/2022	8/17/2022	0.2878 g	<0.0080 % wt
	Site: 3RD FL HALL GRAY BASEBOARD				
GISL-3	*202207061-0003*	7/28/2022	8/17/2022	0.2591 g	0.010 % wt
	Site: 310 BEIGE WALL				
GISL-4	*202207061-0004*	7/28/2022	8/17/2022	0.2543 g	0.23 % wt
	Site: NORTH STAIRWELL BEIGE WALL				
GISL-5	*202207061-0005*	7/28/2022	8/17/2022	0.2609 g	0.19 % wt
	Site: 305 BEIGE WALL				
GISL-6	*202207061-0006*	7/28/2022	8/17/2022	0.2651 g	0.048 % wt
	Site: 306 BEIGE BAY WINDOW				
GISL-7	*202207061-0007*	7/28/2022	8/17/2022	0.2626 g	1.5 % wt
	Site: 304 BEIGE WINDOW				
GISL-8	*202207061-0008*	7/28/2022	8/17/2022	0.2821 g	0.47 % wt
	Site: 303 BEIGE WINDOW SILL				
GISL-9	*202207061-0009*	7/28/2022	8/17/2022	0.2897 g	0.29 % wt
	Site: 217 BEIGE WALL				
GISL-10	*202207061-0010*	7/28/2022	8/17/2022	0.2745 g	0.078 % wt
	Site: 219 BEIGE WOOD TRIM				
GISL-11	*202207061-0011*	7/28/2022	8/17/2022	0.2631 g	<0.0080 % wt
	Site: 2ND FL NORTH HALL BEIGE WALL				
GISL-12	*202207061-0012*	7/28/2022	8/17/2022	0.2608 g	0.11 % wt
	Site: 215 AQUA DOOR				
GISL-13	*202207061-0013*	7/28/2022	8/17/2022	0.2632 g	<0.0080 % wt
	Site: NORTH HALL STAIRWELL BEIGE WALL				
GISL-14	*202207061-0014*	7/28/2022	8/17/2022	0.2843 g	0.094 % wt
	Site: 200 BEIGE WINDOW SILL				
GISL-15	*202207061-0015*	7/28/2022	8/17/2022	0.2638 g	16 % wt
	Site: EXTERIOR DOOR #01 WHITE				

Owen Mckenna, Lead Laboratory Director
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted.
* Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request.
Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 08/17/2022 16:32:52

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.EMSL.com cinnaminsonleadlab@emsl.com

EMSL Order:	202207061
CustomerID:	PARS51
CustomerPO:	1200-42
ProjectID:	

Attn: **Julian Fernandez-Obregon**
PARS Environmental
500 Horizon Drive
Suite 540
Robbinsville, NJ 08691

Phone:	(609) 890-7277
Fax:	(609) 890-9116
Received:	8/15/2022 10:00 AM
Collected:	7/28/2022

Project: **ROWAN - GIS**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Weight*	*Lead Concentration*
GISL-16	*202207061-0016*	7/28/2022	8/17/2022	0.2540 g	<0.0080 % wt
	Site: 116 HALL BEIGE WALL				
GISL-17	*202207061-0017*	7/28/2022	8/17/2022	0.2523 g	0.21 % wt
	Site: LIBRARY 112 BEIGE WALL				
GISL-18	*202207061-0018*	7/28/2022	8/17/2022	0.2553 g	<0.0080 % wt
	Site: HALLWAY BY 112 MUSTARD BEIGE WALL				
GISL-19	*202207061-0019*	7/28/2022	8/17/2022	0.2925 g	<0.0080 % wt
	Site: 109 BEIGE WALL				
GISL-20	*202207061-0020*	7/28/2022	8/15/2022	0.2798 g	0.049 % wt
	Site: 110-3 BEIGE CEILING				
GISL-21	*202207061-0021*	7/28/2022	8/17/2022	0.2507 g	0.074 % wt
	Site: STAFF DINING 105 BEIGE WALL				
GISL-22	*202207061-0022*	7/28/2022	8/15/2022	0.2898 g	0.10 % wt
	Site: CAFETERIA 104 BEIGE WALL				
GISL-23	*202207061-0023*	7/28/2022	8/15/2022	0.2798 g	0.015 % wt
	Site: HALLWAY BY 103 GRAY FLOOR				
GISL-24	*202207061-0024*	7/28/2022	8/15/2022	0.2913 g	0.34 % wt
	Site: HALLWAY BY 106 BEIGE WALL				
GISL-25	*202207061-0025*	7/28/2022	8/15/2022	0.2613 g	0.21 % wt
	Site: KITCHEN WHITE WALL				
GISL-26	*202207061-0026*	7/28/2022	8/15/2022	0.2563 g	0.35 % wt
	Site: HALLWAY BY 100				
GISL-27	*202207061-0027*	7/28/2022	8/15/2022	0.2855 g	0.19 % wt
	Site: BASEMENT BY BACK-STREET GRAY FLOOR				
GISL-28	*202207061-0028*	7/28/2022	8/15/2022	0.2801 g	<0.0080 % wt
	Site: BASEMENT BY BACK-STREET GREEN WALL				
GISL-29	*202207061-0029*	7/28/2022	8/15/2022	0.2701 g	0.31 % wt
	Site: BASEMENT BY BACK-STREET HALLWAY WHITE WALL				
GISL-30	*202207061-0030*	7/28/2022	8/15/2022	0.2580 g	0.20 % wt
	Site: BASEMENT BY BACK-STREET GRAY BASEBOARD				

Owen Mckenna, Lead Laboratory Director
or other approved signatory

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Initial report from 08/17/2022 16:32:52

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.EMSL.com cinnaminsonleadlab@emsl.com

EMSL Order:	202207061
CustomerID:	PARS51
CustomerPO:	1200-42
ProjectID:	

Attn: **Julian Fernandez-Obregon**
PARS Environmental
500 Horizon Drive
Suite 540
Robbinsville, NJ 08691

Phone:	(609) 890-7277
Fax:	(609) 890-9116
Received:	8/15/2022 10:00 AM
Collected:	7/28/2022

Project: **ROWAN - GIS**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Weight*	*Lead Concentration*
GISL-31	*202207061-0031*	7/28/2022	8/15/2022	0.2543 g	1.2 % wt
	Site: BASEMENT BY STREET WHITE DOOR				
GISL-32	*202207061-0032*	7/28/2022	8/15/2022	0.2988 g	2.1 % wt
	Site: BASEMENT BY STREET RED DOOR				

The MS recovery for Lead associated with sample -0024 was outside of the method control limits low.

Owen Mckenna, Lead Laboratory Director
or other approved signatory

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Initial report from 08/17/2022 16:32:52

OrderID: 042220643

Asbestos Chain of Custody

EMSL Order Number *(Lab Use Only)*: 042220643

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

EMSL ANALYTICAL, INC.
200 ROUTE 130 N
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5973

RECEIVED
EMSL
CINNAMINSON, NJ
22 AUG 18 AM 10:12

Company : PARS Environmental		**EMSL-Bill to:** ☒ Same ☐ Different If Bill to is Different note instructions in Comments** *Third Party Billing requires written authorization from third party*	
Street: 500 Horizon Drive, Suite 540			
City: Robbinsville	**State/Province: NJ**	**Zip/Postal Code: 08691**	**Country: USA**
Report To (Name): Julian Fernandez-Obregon		**Fax #: 609-890-9116**	
Telephone #: 609-890-7277		**Email Address: jfernandez@montrose-env.com**	
Project Name/Number: Rowan - GIS Roof			
Please Provide Results: ☐ Fax ☒ Email	**Purchase Order:** 1200-92	**U.S. State Samples Taken: NJ**	

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☑ 1 Week ☐ 2 Week

**For TEM Air 3 hr through 6 hr, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air
- ☐ NIOSH 7400
- ☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
- ☑ PLM EPA 600/R-93/116 (<1%)
- ☑ PLM EPA NOB (<1%)

Point Count
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)

Point Count w/Gravimetric
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- ☐ NYS 198.1 (friable in NY)
- ☐ NYS 198.6 NOB (non-friable-NY)
- ☐ NIOSH 9002 (<1%)

TEM – Air ☐ **4-4.5hr TAT (AHERA only)**
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312

TEM - Bulk
- ☑ TEM EPA NOB
- ☐ NYS NOB 198.4 (non-friable-NY)
- ☐ Chatfield SOP
- ☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2
- Fibers >10µm ☐ Waste ☐ Drinking
- All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
- ☐ Microvac - ASTM D 5755
- ☐ Wipe - ASTM D6480
- ☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
- ☐ PLM CARB 435 - A (0.25% sensitivity)
- ☐ PLM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - C (0.01% sensitivity)
- ☐ EPA Protocol (Semi-Quantitative)
- ☐ EPA Protocol (Quantitative)

Other:
- ☐

☑ **Check For Positive Stop – Clearly Identify Homogenous Group**

Samplers Name: Collin Oriente **Samplers Signature:** CO

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
	See Attached		

Client Sample # (s): - **Total # of Samples:** 51

Relinquished (Client): CO **Date:** 8/18/22 **Time:**

Received (Lab): CO WF **Date:** 8/18/22 **Time:** 10:10

Comments/Special Instructions: Only run one sample per Homogenous Area via TEM, if negative via PLM / PLM NOB, not all samples

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: CO Site Location Glassboro Intermediate School - 202 Delsea Dr N Page: 2

RECEIVED EMSL CINCINNATI OH 22 AUG 18 AM 10:12

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-1	Black Mats	GISR-1 GISR-2 GISR-3	Roof 1 Lower Right		D	
M-2	Silver roof liner paint	GISR-4 GISR-5 GISR-6	Roof 1 Lower Right		D	
M-3	Roof Core	GISR-7 GISR-14 GISR-27	Roof 1 lower Right, midde, and lower left		D	
M-4	HVAC Skirt	GISR-8 GISR-9 GISR-10	Roof 1 lower Right		G	
M-5	Tar	GISR-11 GISR-12 GISR-13	Roof 1 middle		D	
M-6	Metal pipe covering	GISR-15 GISR-16 GISR-17	Roof 1 middle		D	
M-7	Ledge Tar	GISR-18 GISR-19 GISR-20	Roof 1 middle		D	
M-8	Copper flashing and mastic	GISR-21 GISR-22 GISR-23	ROOF 1 Upper left		D	
M-9	Tar and Sealant	GISR-24 GISR-25 GISR-26	Roof 1 Upper left		D	
M-10	Black caulk	GISR-28 GISR-29 GISR-30	Roof 1 lower left		D	

Signature: [signature] Date Sampled: 8/17/22 PARS Project #: 1200-42

OrderID: 042220643

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: CO Site Location Glassboro Intermediate School - 203 Delsea Dr N Page: 3

RECEIVED EMSL CINNAMINSON NJ 22 AUG 18 AM 10:12

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-11	White Caulk	GISR-31 GISR-32 GISR-33	Roof 1 Lower Left		D	
M-12	White Caulk	GISR-34 GISR-35 GISR-36	Roof 2 Lower Right		D	
M-13	Black Caulk	GISR-37 GISR-38 GISR-39	Roof 2 Lower Right		D	
M-14	Roof Core	GISR-40 GISR-40A	Roof 2 Lower Right		D	
M-15	Black mastic	GISR-41 GISR-42 GISR-43	Roof 2 Upper Right		D	
M-16	Roof Core	GISR-44 GISR-48 GISR-51	Roof 2 Upper Right, upper left		D	
M-17	Black tar sealant	GISR-45 GISR-46 GISR-47	Roof 2 Upper left		D	
M-18	Roof core	GISR-49 GISR-50	Roof 3		D	

Signature: Date Sampled: 8/17/22 PARS Project #: 1200-42

Page 3 Of 3

OrderID: 042220643

EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Attn: Julian Fernandez-Obgegon
PARS Environmental
500 Horizon Drive
Suite 540
Robbinsville, NJ 08691

Phone:	(609) 890-7277
Fax:	(609) 890-9116
Collected:	
Received:	8/18/2022
Analyzed:	8/29/2022

Proj: Rowan - GIS Roof / Glassboro Later Mediatc School - 202 Delsea Dr. N. (Rowan University)

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-1 ***Lab Sample ID:*** **042220643-0001**
Sample Description: Roof 1 - Lower Right/Black Mats

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	White/Black	8.3%	91.7%	None Detected	
TEM Grav. Reduction	8/29/2022	White/Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-2 ***Lab Sample ID:*** **042220643-0002**
Sample Description: Roof 1 - Lower Right/Black Mats

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	White/Black	7.9%	92.1%	None Detected	

Client Sample ID: GISR-3 ***Lab Sample ID:*** **042220643-0003**
Sample Description: Roof 1 - Lower Right/Black Mats

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	White/Black	9.8%	90.2%	None Detected	

Client Sample ID: GISR-4 ***Lab Sample ID:*** **042220643-0004**
Sample Description: Roof 1 - Lower Right/Silver Roof Liner Paint

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black/Silver	0.89%	99.1%	None Detected	
TEM Grav. Reduction	8/29/2022	Black/Silver	0.0%	100.0%	None Detected	

Client Sample ID: GISR-5 ***Lab Sample ID:*** **042220643-0005**
Sample Description: Roof 1 - Lower Right/Silver Roof Liner Paint

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black/Silver	1.2%	98.8%	None Detected	

Client Sample ID: GISR-6 ***Lab Sample ID:*** **042220643-0006**
Sample Description: Roof 1 - Lower Right/Silver Roof Liner Paint

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black/Silver	0.0%	100%	None Detected	

Client Sample ID: GISR-7-Roofing ***Lab Sample ID:*** **042220643-0007**
Sample Description: Roof 1 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	11.2%	88.8%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-7-Tar **Lab Sample ID:** **042220643-0007A**

Sample Description: Roof 1 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-7-Tar Felt **Lab Sample ID:** **042220643-0007B**

Sample Description: Roof 1 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	4.1%	95.9%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-7-Tar Paper **Lab Sample ID:** **042220643-0007C**

Sample Description: Roof 1 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.58%	99.4%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-7-Insulation **Lab Sample ID:** **042220643-0007D**

Sample Description: Roof 1 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Gray	80.0%	20.0%	None Detected	

Client Sample ID: GISR-7-Foam **Lab Sample ID:** **042220643-0007E**

Sample Description: Roof 1 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GISR-8 **Lab Sample ID:** **042220643-0008**

Sample Description: Roof 1 - Lower Right/HVAC Skirt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-9 **Lab Sample ID:** **042220643-0009**

Sample Description: Roof 1 - Lower Right/HVAC Skirt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	

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EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-10 ***Lab Sample ID:*** **042220643-0010**
Sample Description: Roof 1 - Lower Right/HVAC Skirt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-11 ***Lab Sample ID:*** **042220643-0011**
Sample Description: Roof 1 - Middle/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-12 ***Lab Sample ID:*** **042220643-0012**
Sample Description: Roof 1 - Middle/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-13 ***Lab Sample ID:*** **042220643-0013**
Sample Description: Roof 1 - Middle/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-14-Roofing ***Lab Sample ID:*** **042220643-0014**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	5.2%	94.8%	None Detected	

Client Sample ID: GISR-14-Tar ***Lab Sample ID:*** **042220643-0014A**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	5.9%	94.1%	None Detected	

Client Sample ID: GISR-14-Tar Felt ***Lab Sample ID:*** **042220643-0014B**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-14-Tar Paper ***Lab Sample ID:*** **042220643-0014C**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.36%	99.6%	None Detected	

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Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-14-Membrane **Lab Sample ID:** **042220643-0014D**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	7.5%	92.5%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-14-Insulation **Lab Sample ID:** **042220643-0014E**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Brown	90.0%	10.0%	None Detected	

Client Sample ID: GISR-14-Foam **Lab Sample ID:** **042220643-0014F**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Black/Yellow	20.0%	80.0%	None Detected	

Client Sample ID: GISR-15 **Lab Sample ID:** **042220643-0015**
Sample Description: Roof 1 - Middle/Metal Pipe Covering

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Silver	0.0%	100.0%	None Detected	
TEM Grav. Reduction	8/29/2022				Insufficient Residue	

Client Sample ID: GISR-16 **Lab Sample ID:** **042220643-0016**
Sample Description: Roof 1 - Middle/Metal Pipe Covering

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Silver	0.0%	100.0%	None Detected	

Client Sample ID: GISR-17 **Lab Sample ID:** **042220643-0017**
Sample Description: Roof 1 - Middle/Metal Pipe Covering

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Silver	0.0%	100.0%	None Detected	

Client Sample ID: GISR-18 **Lab Sample ID:** **042220643-0018**
Sample Description: Roof 1 - Middle/Ledge Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	97.0%	**3.0% Chrysotile**	

Client Sample ID: GISR-19 **Lab Sample ID:** **042220643-0019**
Sample Description: Roof 1 - Middle/Ledge Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

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Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-20 ***Lab Sample ID:*** **042220643-0020**
Sample Description: Roof 1 - Middle/Ledge Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-21-Flashing ***Lab Sample ID:*** **042220643-0021**
Sample Description: Roof 1 - Upper Left/Copper Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Gold/Orange	0.0%	100.0%	None Detected	
TEM Grav. Reduction	8/29/2022				Insufficient Residue	

Client Sample ID: GISR-21-Mastic ***Lab Sample ID:*** **042220643-0021A**
Sample Description: Roof 1 - Upper Left/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Green	0.0%	94.7%	**5.3% Chrysotile**	

Client Sample ID: GISR-22-Flashing ***Lab Sample ID:*** **042220643-0022**
Sample Description: Roof 1 - Upper Left/Copper Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Gold/Orange	0.0%	100.0%	None Detected	

Client Sample ID: GISR-22-Mastic ***Lab Sample ID:*** **042220643-0022A**
Sample Description: Roof 1 - Upper Left/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-23-Flashing ***Lab Sample ID:*** **042220643-0023**
Sample Description: Roof 1 - Upper Left/Copper Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Gold	0.0%	100.0%	None Detected	

Client Sample ID: GISR-23-Mastic ***Lab Sample ID:*** **042220643-0023A**
Sample Description: Roof 1 - Upper Left/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Insufficient Material	

Client Sample ID: GISR-24-Tar ***Lab Sample ID:*** **042220643-0024**
Sample Description: Roof 1 - Upper Left/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	**<0.25% Chrysotile**	
TEM Grav. Reduction	8/29/2022	Black	0.00%	99.54%	**0.46% Chrysotile**	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-24-Sealant **Lab Sample ID:** **042220643-0024A**
Sample Description: Roof 1 - Upper Left/Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	91.8%	**8.2% Chrysotile**	

Client Sample ID: GISR-25-Tar **Lab Sample ID:** **042220643-0025**
Sample Description: Roof 1 - Upper Left/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	97.7%	**2.3% Chrysotile**	

Client Sample ID: GISR-26-Tar **Lab Sample ID:** **042220643-0026**
Sample Description: Roof 1 - Upper Left/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-26-Sealant **Lab Sample ID:** **042220643-0026A**
Sample Description: Roof 1 - Upper Left/Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-27-Roofing **Lab Sample ID:** **042220643-0027**
Sample Description: Roof 1 - Lower Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	12.6%	87.4%	None Detected	

Client Sample ID: GISR-27-Tar **Lab Sample ID:** **042220643-0027A**
Sample Description: Roof 1 - Lower Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	1.2%	98.8%	None Detected	

Client Sample ID: GISR-27-Tar Felt **Lab Sample ID:** **042220643-0027B**
Sample Description: Roof 1 - Lower Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	4.3%	95.7%	None Detected	

Client Sample ID: GISR-27-Tar Paper **Lab Sample ID:** **042220643-0027C**
Sample Description: Roof 1 - Lower Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Brown	<0.25%	100%	None Detected	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-27-Insulation **Lab Sample ID:** **042220643-0027D**
Sample Description: Roof 1 - Lower Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GISR-27-Foam **Lab Sample ID:** **042220643-0027E**
Sample Description: Roof 1 - Lower Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Black/Yellow	25.0%	75.0%	None Detected	

Client Sample ID: GISR-28 **Lab Sample ID:** **042220643-0028**
Sample Description: Roof 1 - Lower Left/Black Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-29 **Lab Sample ID:** **042220643-0029**
Sample Description: Roof 1 - Lower Left/Black Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-30 **Lab Sample ID:** **042220643-0030**
Sample Description: Roof 1 - Lower Left/Black Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-31 **Lab Sample ID:** **042220643-0031**
Sample Description: Roof 1 - Lower Left/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	White	0.0%	97.2%	**2.8% Chrysotile**	

Client Sample ID: GISR-32 **Lab Sample ID:** **042220643-0032**
Sample Description: Roof 1 - Lower Left/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-33 **Lab Sample ID:** **042220643-0033**
Sample Description: Roof 1 - Lower Left/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-34 ***Lab Sample ID:*** **042220643-0034**
Sample Description: Roof 2 - Lower Right/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/29/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GISR-35 ***Lab Sample ID:*** **042220643-0035**
Sample Description: Roof 2 - Lower Right/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	White	0.0%	100%	None Detected	

Client Sample ID: GISR-36 ***Lab Sample ID:*** **042220643-0036**
Sample Description: Roof 2 - Lower Right/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	White	0.0%	100%	None Detected	

Client Sample ID: GISR-37 ***Lab Sample ID:*** **042220643-0037**
Sample Description: Roof 2 - Lower Right/Black Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	93.1%	**6.9% Chrysotile**	

Client Sample ID: GISR-38 ***Lab Sample ID:*** **042220643-0038**
Sample Description: Roof 2 - Lower Right/Black Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-39 ***Lab Sample ID:*** **042220643-0039**
Sample Description: Roof 2 - Lower Right/Black Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-40-Roofing ***Lab Sample ID:*** **042220643-0040**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	10.8%	89.2%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-40-Tar ***Lab Sample ID:*** **042220643-0040A**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	<0.25%	100%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.00%	99.79%	**0.21% Chrysotile**	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-40-Tar Felt **Lab Sample ID:** **042220643-0040B**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	3.3%	96.7%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-40-Insulation **Lab Sample ID:** **042220643-0040C**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Brown/Gray	18.0%	82.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GISR-40A-Roofing **Lab Sample ID:** **042220643-0041**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	9.1%	90.9%	None Detected	

Client Sample ID: GISR-40A-Tar **Lab Sample ID:** **042220643-0041A**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-40A-Tar Felt **Lab Sample ID:** **042220643-0041B**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	5.5%	94.5%	None Detected	

Client Sample ID: GISR-40A-Insulation **Lab Sample ID:** **042220643-0041C**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Gray	40.0%	60.0%	None Detected	

Client Sample ID: GISR-41 **Lab Sample ID:** **042220643-0042**
Sample Description: Roof 2 - Upper Right/Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	99.3%	**0.72% Chrysotile**	
TEM Grav. Reduction	8/29/2022	Black	0.0%	93.3%	**6.7% Chrysotile**	

Client Sample ID: GISR-42 **Lab Sample ID:** **042220643-0043**
Sample Description: Roof 2 - Upper Right/Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.0%	96.5%	**3.5% Chrysotile**	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-43 ***Lab Sample ID:*** **042220643-0044**

Sample Description: Roof 2 - Upper Right/Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-44-Roofing ***Lab Sample ID:*** **042220643-0045**

Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	7.8%	92.2%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	**<0.17% Chrysotile**	

Client Sample ID: GISR-44-Tar Felt ***Lab Sample ID:*** **042220643-0045A**

Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	3.0%	96.3%	**0.72% Chrysotile**	
TEM Grav. Reduction	8/29/2022	Black	0.0%	97.6%	**2.4% Chrysotile**	

Client Sample ID: GISR-44-Tar Paper ***Lab Sample ID:*** **042220643-0045B**

Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	98.9%	**1.1% Chrysotile**	

Client Sample ID: GISR-44-Tar ***Lab Sample ID:*** **042220643-0045C**

Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	100%	**<0.25% Chrysotile**	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	**<0.1% Chrysotile**	

Client Sample ID: GISR-44-Insulation ***Lab Sample ID:*** **042220643-0045D**

Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Brown/Gray/Black	90.0%	10.0%	None Detected	

Client Sample ID: GISR-45 ***Lab Sample ID:*** **042220643-0046**

Sample Description: Roof 2 - Upper Left/Black Tar Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	99.4%	**0.61% Chrysotile**	
TEM Grav. Reduction	8/29/2022	Black	0.0%	93.9%	**6.1% Chrysotile**	

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EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-46 ***Lab Sample ID:*** **042220643-0047**
Sample Description: Roof 2 - Upper Left/Black Tar Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	97.3%	**2.7% Chrysotile**	

Client Sample ID: GISR-47 ***Lab Sample ID:*** **042220643-0048**
Sample Description: Roof 2 - Upper Left/Black Tar Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022			Positive Stop (Not Analyzed)		

Client Sample ID: GISR-48-Roofing ***Lab Sample ID:*** **042220643-0049**
Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-48-Tar Felt ***Lab Sample ID:*** **042220643-0049A**
Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	1.1%	98.9%	None Detected	

Client Sample ID: GISR-48-Tar ***Lab Sample ID:*** **042220643-0049B**
Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	4.2%	95.8%	None Detected	

Client Sample ID: GISR-48-Insulation ***Lab Sample ID:*** **042220643-0049C**
Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Black	45.0%	55.0%	None Detected	

Client Sample ID: GISR-49-Roofing ***Lab Sample ID:*** **042220643-0050**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	White/Black	4.8%	95.2%	None Detected	
TEM Grav. Reduction	8/29/2022	White/Black	0.0%	100.0%	**<0.19% Chrysotile**	

Client Sample ID: GISR-49-Tar Felt ***Lab Sample ID:*** **042220643-0050A**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	3.9%	96.1%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

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EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-49-Tar **Lab Sample ID:** **042220643-0050B**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	1.2%	98.8%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-50-Roofing **Lab Sample ID:** **042220643-0051**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	White/Black	8.5%	91.5%	None Detected	

Client Sample ID: GISR-50-Tar Felt **Lab Sample ID:** **042220643-0051A**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	8.6%	91.4%	None Detected	

Client Sample ID: GISR-50-Tar Paper **Lab Sample ID:** **042220643-0051B**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.0%	100%	**<0.1% Chrysotile**	

Client Sample ID: GISR-50-Tar **Lab Sample ID:** **042220643-0051C**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: GISR-50-Insulation **Lab Sample ID:** **042220643-0051D**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Brown	80.0%	20.0%	None Detected	

Client Sample ID: GISR-50-Foam **Lab Sample ID:** **042220643-0051E**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Tan/Black/Yellow	15.0%	85.0%	None Detected	

Client Sample ID: GISR-51-Roofing **Lab Sample ID:** **042220643-0052**
Sample Description: Roof 2 - Upper Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.82%	99.2%	None Detected	

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EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-51-Tar **Lab Sample ID:** **042220643-0052A**

Sample Description: Roof 2 - Upper Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: GISR-51-Insulation **Lab Sample ID:** **042220643-0052B**

Sample Description: Roof 2 - Upper Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Brown	80.0%	20.0%	None Detected	

Analyst(s):

Andrew Borsos	PLM (12) PLM Grav. Reduction (10)
Corinne Lunden	PLM Grav. Reduction (24)
Debbie Little	TEM Grav. Reduction (12)
Julianna Hosbach	PLM Grav. Reduction (30)
Sarah Kleinbrahm	PLM (7)
Seri Smith	TEM Grav. Reduction (11)

Reviewed and approved by:

Samantha Rundstrom, Laboratory Manager
or Other Approved Signatory

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Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ PA ID# 68-00367, NVLAP Lab Code 101048-0

Initial report from: 08/29/202221:43:01

Appendix E

Lead in Construction Standard Summary

OSHA Lead in Construction Standard Summary

As outlined in the preamble to the U.S. Department of Labor OSHA Construction Standard for Lead (29 CFR 1926.62 Lead), the lead in construction standard is applicable to all occupational exposure to lead in all construction work in which lead in any amount is present in an occupationally related context.

Based on the detected levels of lead in paint, the OSHA Construction Standard for Lead (29 CFR 1926.62 Lead) is applicable to all construction work at this site since employees may be occupationally exposed to lead. OSHA has included within the regulatory text three lists of tasks, the performance of which in the presence of lead, trigger basic protective provisions prior to air lead monitoring:

Task-related Trigger-1
The OSHA regulation, section (d), part (2) "protection of employees during assessment of exposure," states that where lead containing coatings or paint is present and the affected components are to be demolished, manually scraped, manually sanded, treated with heat gun application and/or power tool cleaned with a dust collection system, that until the employer performs an employee exposure assessment and documents that the employee(s) performing the demolition/renovation is not exposed to lead in excess of 500 micrograms per cubic meter (ug/m^3), which is 10 times the Personal Exposure Limit (PEL), the employer shall treat the employee as if the employee were exposed to lead above the PEL, and not in excess of ten (10) times the PEL, and shall implement employee protective measures.

Task-related Trigger-2
The OSHA regulation, section (d), part (2) "protection of employees during assessment of exposure," states that where lead containing coatings or paint is present and the affected components are to be rivet busted, power tool cleaned without dust collection systems, cleanup activities where dry expendable abrasives are used, abrasive blasting enclosure movement or removal or using lead containing mortar (lead burning), that until the employer performs an employee exposure assessment and documents that the employee(s) performing the listed tasks is not exposed to lead in excess of 500 ug/m^3, the employer shall treat the employee as if the employee were exposed to lead in excess of 500 ug/m^3 and shall implement employee protective measures as outlined within the regulation. Where the employer does establish that the employee is exposed to levels of lead below 500 ug/m^3, the employer may provide the exposed employee with the appropriate respirator prescribed for use at such lower exposures, in accordance with the regulation.

Task-related Trigger-3
The OSHA regulation, section (d), part (2) "protection of employees during assessment of exposure," states that where lead containing coatings or paint is present and the affected components are to be abrasive blasted, welded, cut or torched), that until the employer performs an employee exposure assessment and documents that the employee(s) performing the listed tasks is not exposed to lead in excess of 2,500 ug/m^3 (50X PEL), the employer shall treat the employee as if the employee were exposed to lead in excess of 2,500 ug/m^3 and shall implement employee protective measures as outlined within the regulation. Where the employer does establish that the

employee is exposed to levels of lead below 2,500 ug/m^3, the employer may provide the exposed employee with the appropriate respirator prescribed for use at such lower exposures, in accordance with the regulation. Until the employer performs an employee exposure assessment and determines actual employee exposure, the employer shall provide the employee(s) with interim protection as follows:

a) Appropriate respiratory protection
b) Appropriate personal protective clothing
c) Change areas
d) Hand washing facilities
e) Biological Monitoring
f) Respiratory, Safety and Hazard Communication Training

Where the employer has previously monitored for lead exposures, and the data was obtained within the past 12 months during work operations conducted under workplace conditions closely resembling the process, type of material, control methods, work practices, and environmental conditions used and prevailing in the employee's current operations, the employer may rely on such earlier monitoring results to satisfy the requirements of the regulation if the sampling and analytical methods meet the accuracy and confidence levels of the regulation.

The employer of construction workers is responsible for the development and implementation of a worker protection program in accordance with 29 CFR 1926.20 and 29 CFR 1926.62 (e). To implement the worker protection program properly, the employer needs to designate a competent person, i.e., one who is capable of identifying existing and predictable hazards or working conditions which are hazardous or dangerous to employees, in accordance with the general safety and health provisions of OSHA's construction standards.

At the minimum, the following elements should be included in the employer's worker protection program for employees exposed to lead:

- Hazard determination, including exposure assessment
- Engineering and work practice controls
- Respiratory protection
- Protective clothing and equipment
- Housekeeping
- Hygiene facilities and practices
- Medical surveillance and provisions for medical removal
- Training
- Signs; and
- Recordkeeping

It is OSHA policy that respirators are not to be used in lieu of engineering and work practices to reduce employee exposures to below the PEL. Respirators can only be used in combination with engineering controls and work practices to control employee exposures. This report is for planning purposes only. This report should not be used as the sole document for lead related activities.

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Phone: (856) 256-5320
Fax:
Collected: 7/10/2025
Received: 7/11/2025
Analyzed: 7/17/2025

Proj: GIS Roof

Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: AB-GIS-71025-1-Shingle **Lab Sample ID:** 042513731-0001
Sample Description: Roof B - Core 1 - C1/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	11.1%	88.9%	None Detected	

Client Sample ID: AB-GIS-71025-1-Membrane **Lab Sample ID:** 042513731-0001A
Sample Description: Roof B - Core 1 - C1/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	20.1%	79.9%	None Detected	

Client Sample ID: AB-GIS-71025-1-Mastic **Lab Sample ID:** 042513731-0001B
Sample Description: Roof B - Core 1 - C1/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black/Yellow	0.87%	99.1%	None Detected	

Client Sample ID: AB-GIS-71025-1-Tar Felt **Lab Sample ID:** 042513731-0001C
Sample Description: Roof B - Core 1 - C1/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-1-Tar Paper **Lab Sample ID:** 042513731-0001D
Sample Description: Roof B - Core 1 - C1/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-1-Tar **Lab Sample ID:** 042513731-0001E
Sample Description: Roof B - Core 1 - C1/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-1-Foil **Lab Sample ID:** 042513731-0001F
Sample Description: Roof B - Core 1 - C1/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Silver	0.0%	100%	None Detected	

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Customer ID: RWAN34
Customer PO:
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: AB-GIS-71025-1-Foam Insulation ***Lab Sample ID:*** **042513731-0001G**
Sample Description: Roof B - Core 1 - C1/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Black/Yellow	20.0%	80.0%	None Detected	

Client Sample ID: AB-GIS-71025-1-Insulation ***Lab Sample ID:*** **042513731-0001H**
Sample Description: Roof B - Core 1 - C1/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Brown	95.0%	5.0%	None Detected	

Client Sample ID: AB-GIS-71025-2-Shingle ***Lab Sample ID:*** **042513731-0002**
Sample Description: Roof B - Core 2 - C2/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	11.6%	88.4%	None Detected	

Client Sample ID: AB-GIS-71025-2-Tar Felt ***Lab Sample ID:*** **042513731-0002A**
Sample Description: Roof B - Core 2 - C2/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	2.4%	97.6%	None Detected	

Client Sample ID: AB-GIS-71025-2-Tar ***Lab Sample ID:*** **042513731-0002B**
Sample Description: Roof B - Core 2 - C2/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.40%	99.6%	None Detected	

Client Sample ID: AB-GIS-71025-2-Insulation ***Lab Sample ID:*** **042513731-0002C**
Sample Description: Roof B - Core 2 - C2/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Brown	95.0%	5.0%	None Detected	

Client Sample ID: AB-GIS-71025-3-Membrane ***Lab Sample ID:*** **042513731-0003**
Sample Description: Roof B - Core 3 - C3/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	11.6%	88.4%	None Detected	

Client Sample ID: AB-GIS-71025-3-Mastic ***Lab Sample ID:*** **042513731-0003A**
Sample Description: Roof B - Core 3 - C3/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black/Yellow	0.0%	100%	None Detected	

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Project ID:

Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: AB-GIS-71025-3-Tar Felt ***Lab Sample ID:*** **042513731-0003B**
Sample Description: Roof B - Core 3 - C3/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	6.2%	93.8%	None Detected	

Client Sample ID: AB-GIS-71025-3-Tar 1 ***Lab Sample ID:*** **042513731-0003C**
Sample Description: Roof B - Core 3 - C3/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	5.1%	94.9%	None Detected	

Client Sample ID: AB-GIS-71025-3-Tar 2 ***Lab Sample ID:*** **042513731-0003D**
Sample Description: Roof B - Core 3 - C3/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: AB-GIS-71025-4-Membrane ***Lab Sample ID:*** **042513731-0004**
Sample Description: Roof B - Core 4 - C4/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	6.8%	93.2%	None Detected	

Client Sample ID: AB-GIS-71025-4-Mastic ***Lab Sample ID:*** **042513731-0004A**
Sample Description: Roof B - Core 4 - C4/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black/Yellow	0.0%	99.5%	**0.47% Chrysotile**	

Client Sample ID: AB-GIS-71025-4-Tar Felt ***Lab Sample ID:*** **042513731-0004B**
Sample Description: Roof B - Core 4 - C4/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	1.7%	98.3%	None Detected	

Client Sample ID: AB-GIS-71025-4-Tar Paper ***Lab Sample ID:*** **042513731-0004C**
Sample Description: Roof B - Core 4 - C4/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.74%	99.3%	None Detected	

Client Sample ID: AB-GIS-71025-4-Tar ***Lab Sample ID:*** **042513731-0004D**
Sample Description: Roof B - Core 4 - C4/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

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Customer PO:
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: AB-GIS-71025-4-Foam Insulation ***Lab Sample ID:*** **042513731-0004E**
Sample Description: Roof B - Core 4 - C4/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Black/Yellow	20.0%	80.0%	None Detected	

Client Sample ID: AB-GIS-71025-4-Insulation ***Lab Sample ID:*** **042513731-0004F**
Sample Description: Roof B - Core 4 - C4/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Brown	95.0%	5.0%	None Detected	

Client Sample ID: AB-GIS-71025-5-Shingle ***Lab Sample ID:*** **042513731-0005**
Sample Description: Roof B - Core 5 - C5/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	6.7%	93.3%	None Detected	

Client Sample ID: AB-GIS-71025-5-Tar Felt ***Lab Sample ID:*** **042513731-0005A**
Sample Description: Roof B - Core 5 - C5/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	2.0%	98.0%	None Detected	

Client Sample ID: AB-GIS-71025-5-Tar Paper ***Lab Sample ID:*** **042513731-0005B**
Sample Description: Roof B - Core 5 - C5/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	<0.25%	100%	None Detected	

Client Sample ID: AB-GIS-71025-5-Tar ***Lab Sample ID:*** **042513731-0005C**
Sample Description: Roof B - Core 5 - C5/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-5-Foam Insulation ***Lab Sample ID:*** **042513731-0005D**
Sample Description: Roof B - Core 5 - C5/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Black/Yellow	20.0%	80.0%	None Detected	

Client Sample ID: AB-GIS-71025-5-Insulation ***Lab Sample ID:*** **042513731-0005E**
Sample Description: Roof B - Core 5 - C5/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Brown	95.0%	5.0%	None Detected	

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Client Sample ID: AB-GIS-71025-6-Shingle ***Lab Sample ID:*** **042513731-0006**
Sample Description: Roof B - Core 6 - C6/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	3.2%	96.8%	None Detected	

Client Sample ID: AB-GIS-71025-6-Membrane ***Lab Sample ID:*** **042513731-0006A**
Sample Description: Roof B - Core 6 - C6/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	11.3%	88.7%	None Detected	

Client Sample ID: AB-GIS-71025-6-Mastic ***Lab Sample ID:*** **042513731-0006B**
Sample Description: Roof B - Core 6 - C6/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black/Yellow	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-6-Tar Felt ***Lab Sample ID:*** **042513731-0006C**
Sample Description: Roof B - Core 6 - C6/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	6.3%	93.7%	None Detected	

Client Sample ID: AB-GIS-71025-6-Tar ***Lab Sample ID:*** **042513731-0006D**
Sample Description: Roof B - Core 6 - C6/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-6-Gypsum ***Lab Sample ID:*** **042513731-0006E**
Sample Description: Roof B - Core 6 - C6/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Brown/White	10.0%	90.0%	None Detected	

Client Sample ID: AB-GIS-71025-7-Shingle ***Lab Sample ID:*** **042513731-0007**
Sample Description: Roof B - Core 7 - C7/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: AB-GIS-71025-7-Membrane ***Lab Sample ID:*** **042513731-0007A**
Sample Description: Roof B - Core 7 - C7/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	**<0.25% Chrysotile**	

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Client Sample ID: AB-GIS-71025-7-Tar Felt ***Lab Sample ID:*** **042513731-0007B**
Sample Description: Roof B - Core 7 - C7/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	1.4%	98.6%	**<0.25% Chrysotile**	

Client Sample ID: AB-GIS-71025-7-Tar Paper ***Lab Sample ID:*** **042513731-0007C**
Sample Description: Roof B - Core 7 - C7/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	79.4%	**20.6% Chrysotile**	

Client Sample ID: AB-GIS-71025-7-Tar ***Lab Sample ID:*** **042513731-0007D**
Sample Description: Roof B - Core 7 - C7/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: AB-GIS-71025-8-Membrane ***Lab Sample ID:*** **042513731-0008**
Sample Description: Roof B - Core 8 - C8/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	13.0%	87.0%	**<0.29% Chrysotile**	

Client Sample ID: AB-GIS-71025-8-Flashing ***Lab Sample ID:*** **042513731-0008A**
Sample Description: Roof B - Core 8 - C8/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black/Silver	1.9%	97.8%	**0.29% Chrysotile**	

Client Sample ID: AB-GIS-71025-8-Tar Felt ***Lab Sample ID:*** **042513731-0008B**
Sample Description: Roof B - Core 8 - C8/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	6.1%	93.9%	**<0.25% Chrysotile**	

Client Sample ID: AB-GIS-71025-8-Tar Paper ***Lab Sample ID:*** **042513731-0008C**
Sample Description: Roof B - Core 8 - C8/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-8-Tar ***Lab Sample ID:*** **042513731-0008D**
Sample Description: Roof B - Core 8 - C8/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

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Client Sample ID: AB-GIS-71025-8-Roofing ***Lab Sample ID:*** **042513731-0008E**
Sample Description: Roof B - Core 8 - C8/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	93.3%	**6.7% Chrysotile**	

Client Sample ID: AB-GIS-71025-8-Foam Insulation ***Lab Sample ID:*** **042513731-0008F**
Sample Description: Roof B - Core 8 - C8/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Black/Yellow	20.0%	80.0%	None Detected	

Client Sample ID: AB-GIS-71025-8-Insulation ***Lab Sample ID:*** **042513731-0008G**
Sample Description: Roof B - Core 8 - C8/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Brown	95.0%	5.0%	None Detected	

Client Sample ID: AB-GIS-71025-9-Shingle ***Lab Sample ID:*** **042513731-0009**
Sample Description: Roof A - Core 9 - C9/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	5.7%	94.3%	None Detected	

Client Sample ID: AB-GIS-71025-9-Tar Felt ***Lab Sample ID:*** **042513731-0009A**
Sample Description: Roof A - Core 9 - C9/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	2.3%	97.7%	**<0.25% Chrysotile**	

Client Sample ID: AB-GIS-71025-9-Tar Paper ***Lab Sample ID:*** **042513731-0009B**
Sample Description: Roof A - Core 9 - C9/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: AB-GIS-71025-9-Tar ***Lab Sample ID:*** **042513731-0009C**
Sample Description: Roof A - Core 9 - C9/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-9-Roofing ***Lab Sample ID:*** **042513731-0009D**
Sample Description: Roof A - Core 9 - C9/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	1.0%	99.0%	**<0.25% Chrysotile**	

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Client Sample ID: AB-GIS-71025-9-Gypsum ***Lab Sample ID:*** **042513731-0009E**
Sample Description: Roof A - Core 9 - C9/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Brown/White	10.0%	90.0%	None Detected	

Client Sample ID: AB-GIS-71025-10-Membrane ***Lab Sample ID:*** **042513731-0010**
Sample Description: Roof A - Core 10 - C10/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	3.7%	96.3%	None Detected	

Client Sample ID: AB-GIS-71025-10-Mastic ***Lab Sample ID:*** **042513731-0010A**
Sample Description: Roof A - Core 10 - C10/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black/Yellow	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-10-Tar Felt ***Lab Sample ID:*** **042513731-0010B**
Sample Description: Roof A - Core 10 - C10/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	1.9%	98.1%	None Detected	

Client Sample ID: AB-GIS-71025-10-Tar Paper ***Lab Sample ID:*** **042513731-0010C**
Sample Description: Roof A - Core 10 - C10/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	8.9%	91.1%	None Detected	

Client Sample ID: AB-GIS-71025-10-Tar ***Lab Sample ID:*** **042513731-0010D**
Sample Description: Roof A - Core 10 - C10/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-10-Roofing ***Lab Sample ID:*** **042513731-0010E**
Sample Description: Roof A - Core 10 - C10/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	**<0.26% Chrysotile**	

Client Sample ID: AB-GIS-71025-11-Membrane ***Lab Sample ID:*** **042513731-0011**
Sample Description: Roof A - Core 11 - C11/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	5.0%	95.0%	**<0.25% Chrysotile**	

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Client Sample ID: AB-GIS-71025-11-Mastic ***Lab Sample ID:*** **042513731-0011A**
Sample Description: Roof A - Core 11 - C11/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black/Yellow	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-11-Tar Felt ***Lab Sample ID:*** **042513731-0011B**
Sample Description: Roof A - Core 11 - C11/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: AB-GIS-71025-11-Tar ***Lab Sample ID:*** **042513731-0011C**
Sample Description: Roof A - Core 11 - C11/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: AB-GIS-71025-11-Roofing ***Lab Sample ID:*** **042513731-0011D**
Sample Description: Roof A - Core 11 - C11/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	**<0.38% Chrysotile**	

Client Sample ID: AB-GIS-71025-11-Insulation ***Lab Sample ID:*** **042513731-0011E**
Sample Description: Roof A - Core 11 - C11/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Brown	95.0%	5.0%	None Detected	

Client Sample ID: AB-GIS-71025-12-Membrane 1 ***Lab Sample ID:*** **042513731-0012**
Sample Description: Roof A - Core 12 - C12/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: AB-GIS-71025-12-Membrane 2 ***Lab Sample ID:*** **042513731-0012A**
Sample Description: Roof A - Core 12 - C12/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	6.4%	93.0%	**0.58% Chrysotile**	

Client Sample ID: AB-GIS-71025-12-Tar Felt ***Lab Sample ID:*** **042513731-0012B**
Sample Description: Roof A - Core 12 - C12/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	1.5%	98.5%	None Detected	

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Client Sample ID: AB-GIS-71025-12-Tar Paper ***Lab Sample ID:*** **042513731-0012C**
Sample Description: Roof A - Core 12 - C12/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	80.9%	**19.1% Chrysotile**	

Client Sample ID: AB-GIS-71025-12-Tar ***Lab Sample ID:*** **042513731-0012D**
Sample Description: Roof A - Core 12 - C12/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-12-Roofing ***Lab Sample ID:*** **042513731-0012E**
Sample Description: Roof A - Core 12 - C12/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	95.2%	**4.8% Chrysotile**	

Client Sample ID: AB-GIS-71025-12-Insulation ***Lab Sample ID:*** **042513731-0012F**
Sample Description: Roof A - Core 12 - C12/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Brown/Black	95.0%	5.0%	None Detected	

Client Sample ID: AB-GIS-71025-13-Membrane ***Lab Sample ID:*** **042513731-0013**
Sample Description: Roof A - Core 13 - C13/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	24.0%	76.0%	None Detected	

Client Sample ID: AB-GIS-71025-13-Tar Felt ***Lab Sample ID:*** **042513731-0013A**
Sample Description: Roof A - Core 13 - C13/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	3.7%	96.3%	None Detected	

Client Sample ID: AB-GIS-71025-13-Tar ***Lab Sample ID:*** **042513731-0013B**
Sample Description: Roof A - Core 13 - C13/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-13-Roofing ***Lab Sample ID:*** **042513731-0013C**
Sample Description: Roof A - Core 13 - C13/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	4.8%	95.2%	**<0.25% Chrysotile**	

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Client Sample ID: AB-GIS-71025-13-Insulation ***Lab Sample ID:*** **042513731-0013D**
Sample Description: Roof A - Core 13 - C13/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/16/2025	Brown	95.0%	5.0%	None Detected	

Client Sample ID: AB-GIS-71025-14-Membrane ***Lab Sample ID:*** **042513731-0014**
Sample Description: Roof A - Core 14 - C14/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	8.4%	91.6%	None Detected	

Client Sample ID: AB-GIS-71025-14-Tar Felt ***Lab Sample ID:*** **042513731-0014A**
Sample Description: Roof A - Core 14 - C14/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.66%	99.3%	None Detected	

Client Sample ID: AB-GIS-71025-14-Tar ***Lab Sample ID:*** **042513731-0014B**
Sample Description: Roof A - Core 14 - C14/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/17/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-14-Roofing ***Lab Sample ID:*** **042513731-0014C**
Sample Description: Roof A - Core 14 - C14/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	5.3%	94.7%	None Detected	

Client Sample ID: AB-GIS-71025-14-Insulation ***Lab Sample ID:*** **042513731-0014D**
Sample Description: Roof A - Core 14 - C14/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/17/2025	Brown	90.0%	10.0%	None Detected	

Client Sample ID: AB-GIS-71025-15-Shingle ***Lab Sample ID:*** **042513731-0015**
Sample Description: Roof A - Core 15 - C15/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Gray/Black	10.4%	89.6%	None Detected	

Client Sample ID: AB-GIS-71025-15-Membrane ***Lab Sample ID:*** **042513731-0015A**
Sample Description: Roof A - Core 15 - C15/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Tan/Black	2.0%	98.0%	None Detected	

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Client Sample ID: AB-GIS-71025-15-Tar Felt ***Lab Sample ID:*** **042513731-0015B**
Sample Description: Roof A - Core 15 - C15/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	1.1%	98.9%	None Detected	

Client Sample ID: AB-GIS-71025-15-Tar ***Lab Sample ID:*** **042513731-0015C**
Sample Description: Roof A - Core 15 - C15/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-15-Roofing ***Lab Sample ID:*** **042513731-0015D**
Sample Description: Roof A - Core 15 - C15/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	5.7%	94.3%	None Detected	

Client Sample ID: AB-GIS-71025-16-Shingle ***Lab Sample ID:*** **042513731-0016**
Sample Description: Roof A - Core 16 - C16/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Gray/Black	7.9%	92.1%	**<0.31% Chrysotile**	

Client Sample ID: AB-GIS-71025-16-Membrane ***Lab Sample ID:*** **042513731-0016A**
Sample Description: Roof A - Core 16 - C16/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-16-Tar Felt ***Lab Sample ID:*** **042513731-0016B**
Sample Description: Roof A - Core 16 - C16/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	4.0%	96.0%	None Detected	

Client Sample ID: AB-GIS-71025-16-Tar Paper ***Lab Sample ID:*** **042513731-0016C**
Sample Description: Roof A - Core 16 - C16/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.0%	100%	None Detected	

Client Sample ID: AB-GIS-71025-16-Tar ***Lab Sample ID:*** **042513731-0016D**
Sample Description: Roof A - Core 16 - C16/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	0.94%	99.1%	None Detected	

EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order ID: 042513731
Customer ID: RWAN34
Customer PO:
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Material

Client Sample ID: AB-GIS-71025-16-Roofing ***Lab Sample ID:*** **042513731-0016E**

Sample Description: Roof A - Core 16 - C16/Roof Core GIS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/16/2025	Black	10.6%	89.4%	None Detected	

Analyst(s):

Amiri Lewis	PLM (1) PLM Grav. Reduction (1)
Hunter Kelly	PLM (14) PLM Grav. Reduction (29)
Kiara Secula	PLM Grav. Reduction (51)

Reviewed and approved by:

Samantha Sweeney, Laboratory Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This is a summary report; official reports are available on LabConnect or upon request and relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ PA ID# 68-00367, NVLAP Lab Code 101048-0

Initial report from: 07/17/202516:16:43

DIGroupArchitecture
ARCHITECTURE FOR CHANGE

ROWAN GIS ROOF CORES

Core #1 BUR

flat metal deck 8½" THK
perlite insu.

Core #2 BUR

flat metal deck 4" THK
perlite insu.

Core #3 BUR

Sloped conc. deck 3" THK.

Core #4 BUR

Sloped metal deck 3½" THK

Core #5 BUR

Sloped metal deck 4" THK

Core #6 BUR

~~Sloped metal deck 3½" THK~~

Sloped Lightweight conc. deck ½" THK.

Core #7 BUR

Sloped Lightweight conc. deck ½" THK.

Core #8 BUR

Sloped concrete deck 3½" THK

Core #9 BUR

Sloped lightweight conc. deck 1" THK
no insu.

Core #10 BUR

Sloped lightweight conc. deck 1" THK
no insu.

DIGroupArchitecture
ARCHITECTURE FOR CHANGE

Core #11 BUR
Sloped conc. deck 1"THK
wood fiber board
no. insu.

Core #14 BUR
Sloped metal deck 4½THK
wood fiber board
poly iso.

Core #10 BUR
Sloped conc. deck 1½" THK
wood fiber board
no. insu.

Core #15 BUR
Sloped conc. deck ½" THK
no insu.

Core #8 BUR
Sloped metal deck 5¼" THK
wood fiber board
poly ISO.

Core #16 BUR
Sloped conc. deck ½" THK
no insu.

PRE-RENOVATION HAZARDOUS MATERIALS SURVEY

Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

PREPARED FOR:
Rowan University
201 Mullica Hill Road
Glassboro, New Jersey 08028

PREPARED BY:
Montrose Environmental, Inc.
500 Horizon Drive, Suite 540
Robbinsville, NJ 08691

MONTROSE PROJECT NO. 1200-42

MONTROSE ENVIRONMENTAL

September 2022

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EXECUTIVE SUMMARY

From July 28, 2022 through August 18, 2022, Montrose Environmental, Inc. (Montrose) conducted a Pre-Renovation Hazardous Materials Survey (hereinafter the "Survey") of Glassboro Intermediate School located at 202 Delsea Drive in Glassboro, New Jersey (hereinafter the "Site"). The objective of the Survey was to conduct a comprehensive asbestos-containing materials (ACM) survey of Site, alongside a lead-based paint (LBP) x-ray fluorescence (XRF) screening, as appropriate. The Site consists of the Glassboro Intermediate School itself, an outbuilding slated for demolition arbitrarily called the "Demo House," two club houses, and the Industrial Arts Building. This report concerns the Glassboro Intermediate School, with the remainder presented under separate cover.

The Glassboro Intermediate School was constructed in 1930, and is a three-story structure over a full basement, with concrete and brick exteriors and a mixture of pitched and flat roofing systems. Interior partitions consist of cinder block, brick, plaster, and drywall. Sampling of the roofing materials was included as part of this Survey.

SUMMARY OF FINDINGS

Asbestos

Asbestos-containing materials were identified throughout Glassboro Intermediate School, with a summary provided in **Table 1**. Representative photographs of sampled materials are provided in **Appendix B**. A location map of confirmed ACM is provided in **Figures 1 through 4**, with a roof area depiction map provided in **Figures 5 and 6.** Laboratory reports are provided in **Appendix D.**

Lead-Based Paint Screening

Lead-based paint was throughout Glassboro Intermediate School, with a summary of the XRF screening provided in **Table 2.** Paint chip sample results are provided in **Table 3.** Representative photographs of sampled materials are provided in **Appendix C**. Laboratory reports are provided in **Appendix D**.

CONCLUSIONS AND RECOMMENDATIONS

ACM is present at the Property at the locations identified above. Those materials that will be subject to demolition or renovation must be removed from the subject area prior to the commencement of such activities in accordance with the requirements of N.J.A.C. 5:23-8. The disposal requirements of major sources of ACM include restrictions on visible emissions, provisions for wetting the ACM, packaging, sealing, labeling, record keeping and reporting in accordance with 40 C.F.R 61.150.

LBP was identified throughout the Site, on original components, which included various door components, plaster and brick walls, stairwell components, window components, and wall trim.

Most LBP that was identified in the Survey was found in 'Intact' condition. No further action is necessary with regards to intact LBP at this time. However, a periodic surveillance program should be implemented to verify and maintain the integrity of the LBP. Periodic surveillance can include employment of interim control methods such as paint film stabilization or enclosure/encapsulation of the LBP. Lead safe work practices should be employed should any of these areas undergo renovation in the future.

1.0 INTRODUCTION

From July 28, 2022 through August 18, 2022, Montrose Environmental, Inc. (Montrose) conducted a Pre-Renovation Hazardous Materials Survey (hereinafter the "Survey") of Glassboro Intermediate School located at 202 Delsea Drive in Glassboro, New Jersey (hereinafter the "Site"). The objective of the Survey was to conduct a comprehensive asbestos-containing materials (ACM) survey of Site, alongside a lead-based paint (LBP) x-ray fluorescence (XRF) survey, as appropriate. The Site consists of the Glassboro Intermediate School itself, an outbuilding slated for demolition arbitrarily called the "Demo House," two club houses, and the Industrial Arts Building. This report concerns the Glassboro Intermediate School, with the remainder presented under separate cover.

The Glassboro Intermediate School was constructed in 1930, and is a three-story structure over a full basement, with concrete and brick exteriors and a mixture of pitched and flat roofing systems. Interior partitions consist of cinder block, brick, plaster, and drywall. Sampling of the roofing materials was included as part of this Survey.

The Survey was completed by Mr. Julian Fernandez-Obregon, Ms. Marissa Weinstein, and Mr. Collin Oriente of Montrose. Mr. Fernandez-Obregon, Ms. Weinstein, and Mr. Oriente are certified Asbestos Hazard Emergency Response Act (AHERA) asbestos inspectors. Mr. Fernandez-Obregon and Ms. Weinstein are also New Jersey Department of Health (NJDOH) Lead Inspectors and Risk Assessors. A copy of relevant certifications are included in **Appendix A**.

The United States Environmental Protection Agency (USEPA) defines an ACM as a material that contains greater than one percent (> 1%) asbestos). The purpose of the ACM Survey was to determine the presence of suspect materials at the Property, sample and test the suspect materials, summarize the findings, and propose additional services that may be needed to comply with current National Emission Standards for Hazardous Air Pollutants (NESHAP), Occupational Safety and Health Administration (OSHA), New Jersey Department of Health (NJDOH), and USEPA regulations prior to the renovation of the Property.

The USEPA and the New Jersey Department of Community Affairs (NJDCA) New Jersey Lead Hazard Evaluation and Abatement Code (N.J.A.C. 5:17) consider painted surfaces containing lead at a concentration of 1.0 milligram per square centimeter (mg/cm^2) or 0.5% by weight or greater to be LBP. Montrose conducted paint chip testing to assess whether LBP was present at levels exceeding the USEPA and NJDCA Lead Hazard Evaluation and Abatement Code.

2.0 METHODOLOGY

2.1 ASBESTOS - CONTAINING MATERIALS (ACM)

From July 28, 2022 through August 18, 2022, Montrose conducted an asbestos survey of the Glassboro Intermediate School. ACM sampling followed USEPA sampling protocols. Collection techniques followed best practices as per USEPA and the AHERA guidelines.

Suspect materials were divided into homogeneous areas, which are building materials evaluated by the inspector to be the same based on their color, texture, and age. Representative samples were collected of each homogeneous material. Suspect materials identified and sampled are listed in **Table 1**.

Bulk samples of suspect materials were collected in 4-mil plastic bags and sealed for transport to the laboratory under chain-of-custody protocols. Each sample was assigned a unique homogeneous application number (M-1 through M-15) and sample identification number (e.g., 8A-1).

The following are the homogeneous material symbols used for identification in this report:

T = Thermal System Insulation
M = Miscellaneous Materials
S = Surfacing Materials (troweled or spray-applied)

<u>Surfacing Materials – S (Plaster, Spray-on or Troweled-on Materials, etc.)</u>

1. At least three bulk samples were collected from each homogeneous area that was 1,000 ft^2 or less.
2. At least five bulk samples were collected from each homogeneous area that was greater than 1,000 ft^2 but less than or equal to 5,000 ft^2.
3. At least seven bulk samples were collected from each homogeneous area that was greater than 5,000 ft^2.

<u>Thermal system insulation – T (Pipe Insulation, Elbows, Boiler Systems, etc.)</u>

1. At least three bulk samples were collected from each homogeneous area of thermal system insulation.
2. Sufficient samples shall be collected from elbows and fittings to determine if it contains ACM.
3. Bulk samples were not collected from any homogeneous area where the State licensed asbestos inspector determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-suspect material.

<u>Miscellaneous Materials – M (Floor Tiles, Mastics, Vinyl Sheeting, etc.)</u>

1. At least one bulk sample was collected from each homogeneous area that was less than 100 ft^2.
2. At least three bulk samples were collected from each homogeneous area that was greater than 100 ft^2.

2.2 LEAD BASED PAINT SURVEY APPROACH

From July 28, 2022, through August 18, 2022, Montrose also collected representative paint chip samples of interior and exterior surfaces that may be impacted by the planned demolition activities.

Montrose collected representative "readings" of presumed lead-containing paint using an XRF device to test for the presence of lead in paint. The XRF used for the evaluation was a Thermo Niton XL3t 800, Serial #114589. XRF sample results are provided in **Table 2**. Chip sample results are provided in **Table 3**.

3.0 ANALYTICAL METHODS

3.1 Asbestos-Containing Materials

Material identification was performed via Polarized Light Microscopy with Dispersion Staining (PLM/DS) in accordance with New Jersey requirements (N.J.A.C. 8:60 and 12:120) using USEPA Method 600/R-93/116 and for Transmission Electron Microscopy (TEM) analysis using USEPA Method 600/R-93/116B Section 2.5.5.1.

For those materials yielding less than 1% asbestos using PLM, Transmission Electron Microscopy (TEM) analysis was performed for confirmation. Laboratory analysis was conducted by EMSL Analytical located in Cinnaminson, New Jersey. EMSL is certified by the National Institute of Standards and Technology and National Voluntary Laboratory Accreditation Program (NIST-NVLAP # 101048) for asbestos analysis. EMSL's certifications are provided in Appendix A.

3.2 Lead-Based Paint

Paint chip sampling was conducted throughout the Site. Paint chip samples were analyzed by EMSL for lead by flame atomic absorption spectroscopy (AAS) via method SW846 3050B/7000B. EMSL is certified by the American Industrial Hygiene Association Environmental Lead Laboratory Accreditation Program (AIHA ELLAP #100194).

XRF calibration and actual readings were taken using the Quantify Lead Paint mode. The calibration of the instrument was performed in accordance with the specifications for this instrument. The instrument was calibrated using the paint film nearest 1.0 mg/cm^2 in the National Institute of Standard & Technology (NIST) Standard Reference Material (e.g., for NIST SRM 2573, 1.2 mg/cm 2 would be used for color code Red and for NIST SRM 2570, <0.001 mg/cm2 would be used for color code White). Three calibration readings were taken before and after the testing to insure manufacturer standards were met.

4.0 RESULTS

4.1 Asbestos-Containing Materials (ACM)

Montrose collected a total of 501 samples of suspect containing materials within the Site, with additional samples analyzed due to layering of samples collected, with **Table 1** summarizing the sampling results.

Based on the laboratory analysis, **ACM was identified** within the Glassboro Intermediate School and includes the following:

Glassboro Intermediate School – Interior

- M-17 Brown/Tan 9"x9" Floor Tile – Third Floor
- M-37 Black Glue Tar – Stair Treads in Stairwells
- M-143 Brown 9"x9" Floor Tile – Basement
- M-144 Mastic Associated with M143 – Basement
- P-1 Pipe Insulation / Elbows – Presumed Behind Fixed Walls*
- P-2 Wire Insulation – Observed in Walls*

Glassboro Intermediate School – Roof

- M-07 Roofing Tar – Roof 1 Middle Ledge
- M-08 Copper Flashing Mastic – Roof 1 Upper Left
- M-09A Sealant – Roof 1 Upper Left
- M-09B Tar – Roof 1 Upper Left
- M-11 White Caulk – Roof 1 Lower Left
- M-13 Black Caulk – Roof 2 Lower Right
- M-14F Roof Core – Tar Felt – Roof 2 Upper Right
- M-14G Roof Core – Tar Paper – Roof 2 Upper Right
- M-15 Black Mastic – Roof 2 Upper Right
- M-16 Black Tar Sealant – Roof 2 Upper Left

* Pipe insulation and elbows and wire insulation are presumed-asbestos containing, located behind fixed walls, given the age of the building. All exposed pipe insulation throughout the school was verified to be fiberglass, and not suspect ACM. Wire insulation was visible in a single area, but may be present behind fixed walls as well. The wire was potentially live, so was not sampled.

Sample locations are depicted on **Figures 1 to 4**, with a roof map provided in **Figures 5 and 6**, noting all of the different roofing designations. Representative photographs of sampled materials are depicted in **Appendix B**. Laboratory reports are provided in **Appendix D**.

4.2 Lead-Based Paint

Montrose performed LBP testing of representative interior and exterior painted surfaces at the Site. A lead reading by the XRF of 1.0 mg/cm^2 or greater is considered positive for the presence of LBP in accordance with the Lead Hazard Evaluation and Abatement Code (N.J.A.C. 5:17). XRF results for the building and locations are presented in **Table 2**. Chip Sample Results are provided in **Table 3.**

A total of 773 XRF readings were taken from suspect LBP components throughout Glassboro Intermediate School.

Results and locations of paint chip samples taken and analyzed are presented in **Table 3**. Representative photos of LBP are presented in **Appendix C**. Results of analysis and chains of custody are included in **Appendix D**.

Identified LBP Surfaces

LBP in amounts equal to or exceeding the USEPA and/or Lead Hazard Evaluation and Abatement Code criteria of 1.0 mg/cm^2 was found on the following painted substrates:

- Exterior – Doors and Door Frames, inclusive of decorative components
- Stairwells – All Components (Railing, Riser, Stringer, Bannister)
- Throughout – Original Brick, Concrete, & Plaster Walls (few)
- Throughout – Original Baseboards
- Throughout – Window Frames, Sills, and Sashes
- Throughout – Original Door Frames and Jambs
- Throughout – Original Archways and Trim

The above substrates are brick, wood, plaster, and concrete. Confirmatory paint chip samples were collected from areas where XRF testing was conducted and were submitted to EMSL for lead analysis to verify XRF readings. All paint chip samples collected from surfaces with negative XRF readings were determined to contain lead concentrations less than the USEPA definition of >0.5%/wt. All paint chip samples collected from surfaces with positive XRF readings were determined to contain lead concentrations greater than the USEPA definition of >0.5%/wt.

Most plaster walls were negative via XRF for LBP, but any impact to concrete or brick walls should be presumed to be LBP for upcoming renovations. All original wood components, doors, windows, baseboards, trim, etc., should be presumed to be LBP, and lead safe work practices be implemented when impacting those materials. A summary of the Lead in Construction standard, 29 CFR 1926.62 is provided in **Appendix E**.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Asbestos-Containing Materials

ACM is present throughout Glassboro Intermediate School, on those materials noted above and in **Table 1**. Those materials that will be subject to demolition or renovation must be removed from the subject area prior to the commencement of such activities in accordance with the requirements of N.J.A.C. 5:23-8. The disposal requirements of major sources of ACM include restrictions on visible emissions, provisions for wetting the ACM, packaging, sealing, labeling, record keeping and reporting in accordance with 40 C.F.R 61.150.

Pipe insulation and elbows and wire insulation are presumed-asbestos containing, located behind fixed walls, given the age of the building. All exposed pipe insulation throughout the school was verified to be fiberglass, and not suspect ACM. Wire insulation was visible in a single area, but may be present behind fixed walls as well. The wire was potentially live, so was not sampled. If future renovations expose fixed wall cavities containing pipe insulation, elbows, or wire insulation, those materials should be tested prior to removal or impact.

Lead-Based Paint

XRF testing indicated there were LBP surfaces throughout Glassboro Intermediate School, mostly on original wood, plaster, brick, or concrete surfaces, with a summary for XRF testing presented in **Table 2**, and paint chip testing presented in **Table 3**.

Lead-safe work practices and worker/occupant protection practices complying with current USEPA and Occupational Safety and Health Administration (OSHA) standards will be necessary to safely complete all work involving the disturbance of LBP coated surfaces and components. In addition, any work considered lead hazard control will enlist the use of interim control (temporary) methods and/or abatement (permanent) methods. It should be noted that all lead hazard control activities have the potential of creating additional hazards, or even creating hazards that were not present before. All persons and/or firms performing lead hazard control activities must have received proper training in Lead-Safe Work Practices and/or Lead Abatement. Details for the listed lead hazard control options and issues surrounding occupant/worker protection practices can be found in the publication titled: *Guidelines for the Evaluation and Control of LBP Hazards in Housing (Second Edition, July 2012)* (HUD Guidelines), published by HUD, as well as in the OSHA regulations found in 29 CPR, Part 1926.62, known as the OSHA Lead Exposure in Construction Industry Standard. A summary of the standard is provided in **Appendix E**.

Based on the findings of the Assessment, Montrose recommends the following action be implemented to minimize the potential exposure to LBP:

Interim Control:

Interim controls are measures designed to temporarily reduce human exposure or possible exposure to lead-based paint hazards. The recommended interim control measures include:

- Paint film stabilization (paint the LBP with a coat of lead-free paint); and/or
- Enclosure or encapsulation.

Interim control measures should be employed for the identified intact LBP surfaces identified during the Survey.

Permanent Control (Abatement):
Abatement is a measure or measures designed to permanently eliminate the LBP hazard. The recommended permanent control measures include:

- Paint removal by a heat gun, chemical or contained abrasive; and/or
- Removal and replacement of LBP building components.
- Abatement of the lead dust hazard via wet wiping and High Efficiency Particulate Air (HEPA) vacuum techniques.

Most of the LBP identified in Glassboro Intermediate School is in intact condition. Montrose recommends interim controls be implemented for intact LBP, including periodic surveillance, to verify the condition of the LBP. As an alternative to *Interim Controls*, an LBP abatement also can be performed on the intact LBP surfaces. If permanent control is the selected remedial option, then a NJ certified Lead Inspector/ Risk Assessor should be retained to collect wipe samples in the affected areas to verify that a lead dust hazard has not been created during the removal activities. Lead safe work practices should be employed should any of these areas undergo renovation in the future.

-o.0.o-

These results represent the conditions and concentrations present at the time of this survey.

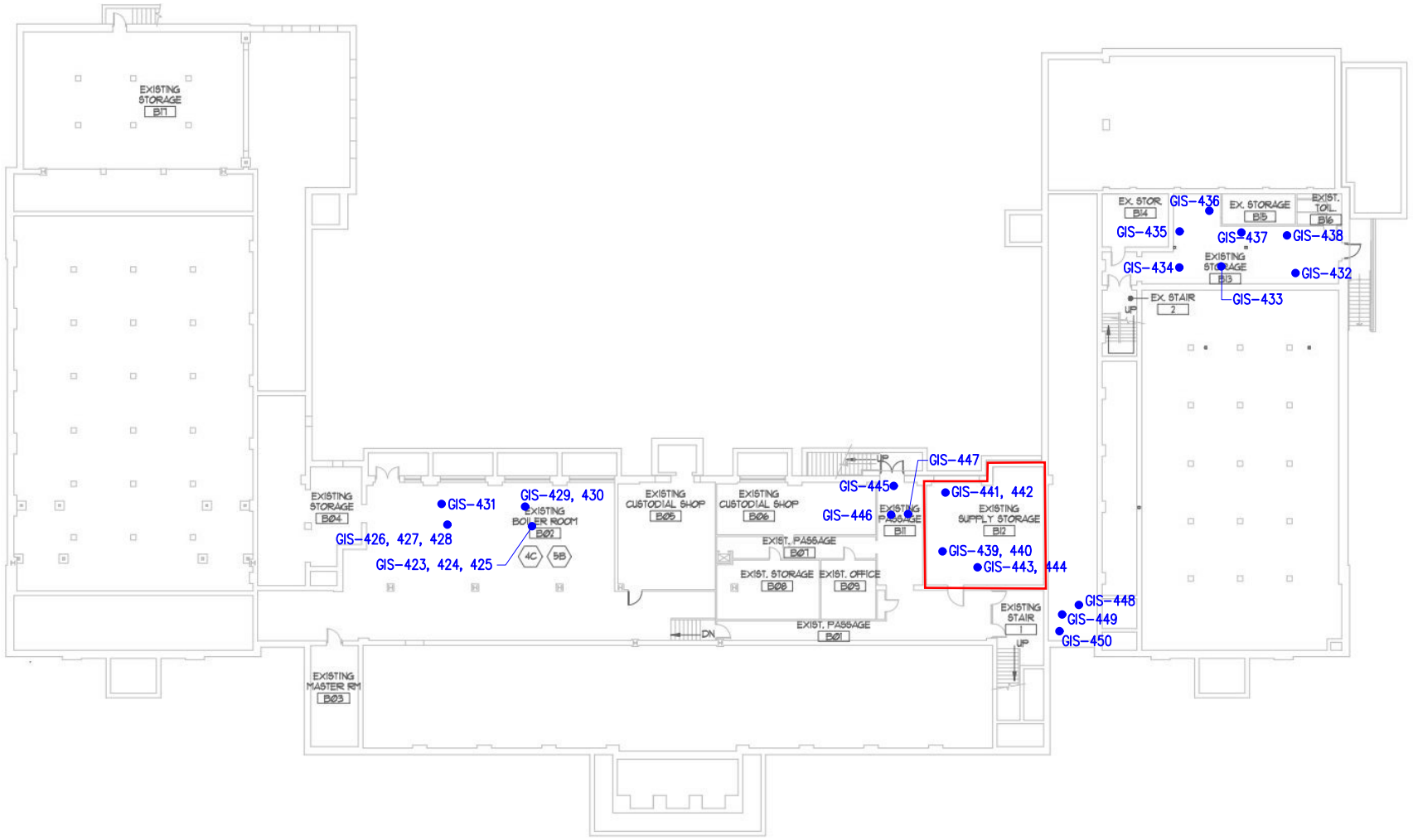
Respectfully Submitted,

MONTROSE ENVIRONMENTAL, INC.

Marissa Weinstein
Staff Health & Safety Specialist

Julian Fernandez-Obregon
Director, Health & Safety Services
Senior Health & Safety Specialist

FIGURES



Basement

Legend

= Sample Location

= Confirmed ACM Location (See Table 1)

DRN: MN	APR: JFO
DATE: 9/14/22	PN: 1200-42

Figure 1
Site Location Map
Glassboro Intermediate School
Glassboro, NJ

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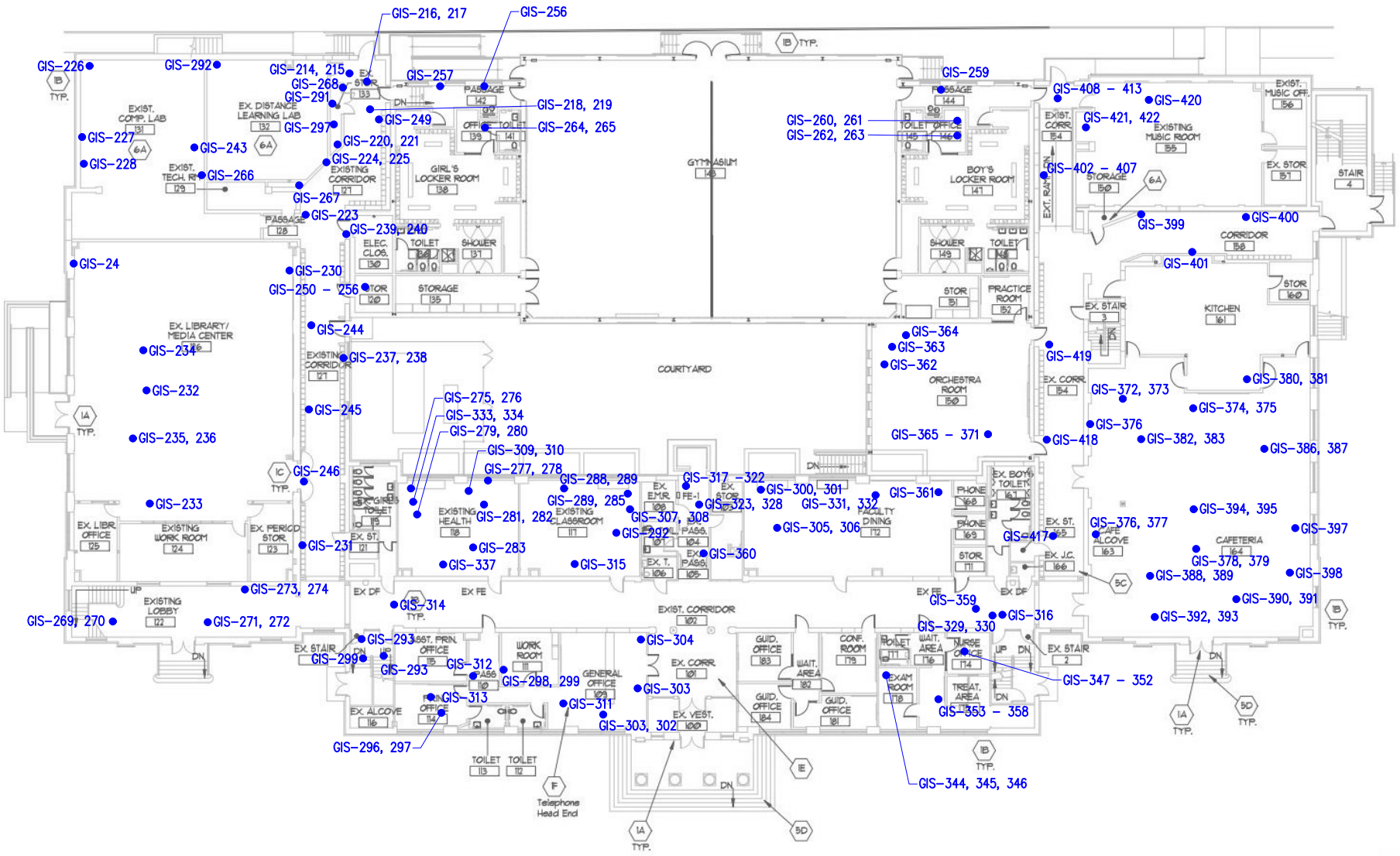

First Floor

Legend

● = Sample Location

DRN: MN	APR: JFO
DATE: 9/14/22	PN: 1200-42

Figure 2
Sample Location Map
Glassboro Intermediate School
Glassboro, NJ

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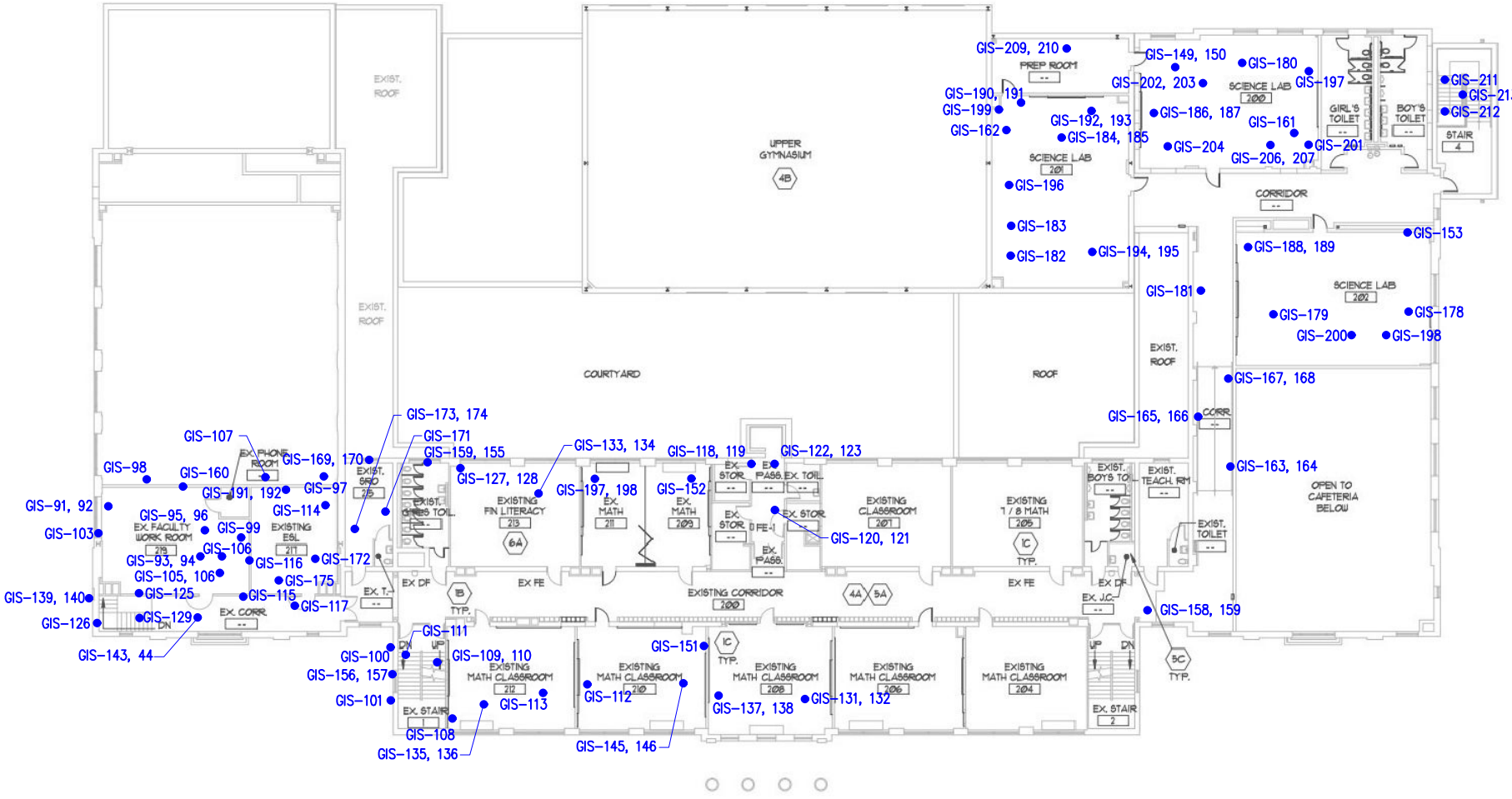


Second Floor

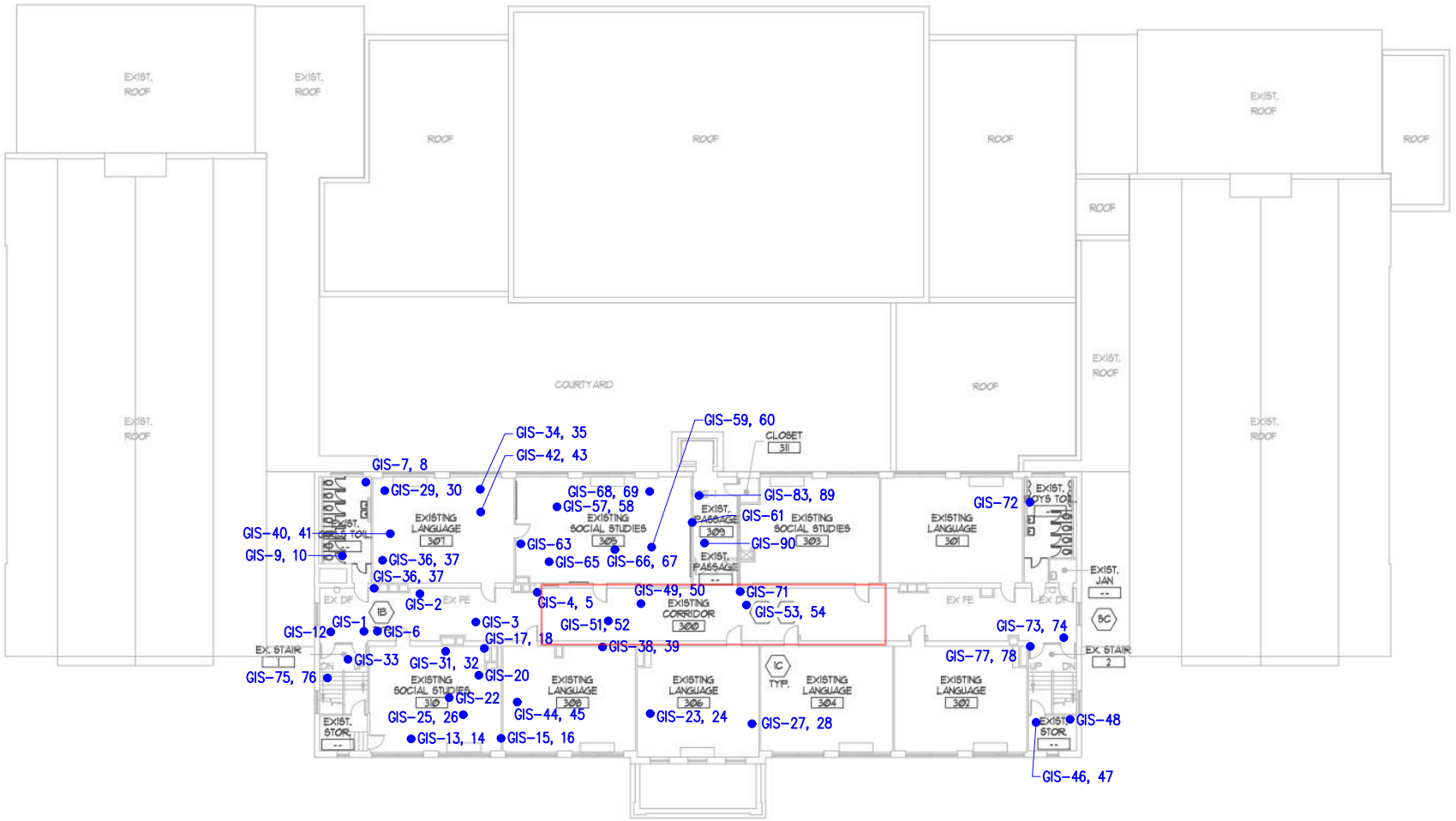
Legend

● = Sample Location

DRN: MN	APR: JFO
DATE: 9/14/22	PN: 1200-42

Figure 3
Sample Location Map
Glassboro Intermediate School
Glassboro, NJ

MONTROSE ENVIRONMENTAL



Third Floor

Legend

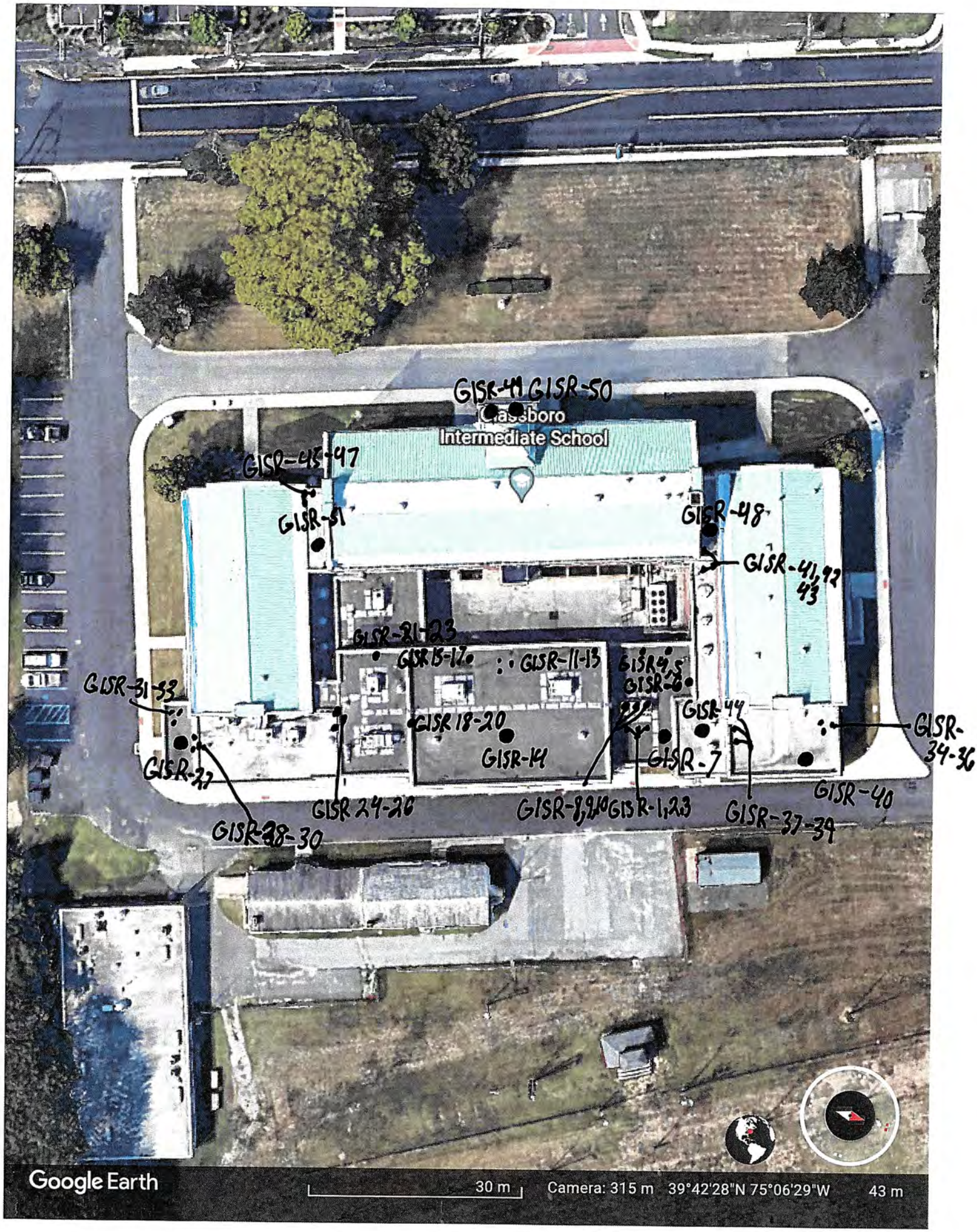
● = Sample Location

◇ = Confirmed ACM Location (See Table 1)

DRN: MN	APR: JFO
DATE: 9/14/22	PN: 1200-42

Figure 4
Sample Location Map
Glassboro Intermediate School
Glassboro, NJ

MONTROSE ENVIRONMENTAL


GISR-49 GISR-50
Glassboro
Intermediate School
GISR-45-47
GISR-51
GISR-48
GISR-41, 42
43
GISR-21-23
GISR 15-17
GISR-11-13
GISR 4-5
GISR-6
GISR-31-33
GISR 18-20
GISR-44
GISR-14
GISR-7
GISR-34-36
GISR-27
GISR 24-26
GISR-8, 10
GISR-1, 2, 3
GISR-37-39
GISR-40
GISR-28-30
Google Earth
30 m
Camera: 315 m 39°42'28"N 75°06'29"W
43 m

LEGEND

ROOF 1

LOWER RIGHT =

MIDDLE =

UPPER LEFT =

LOWER LEFT =

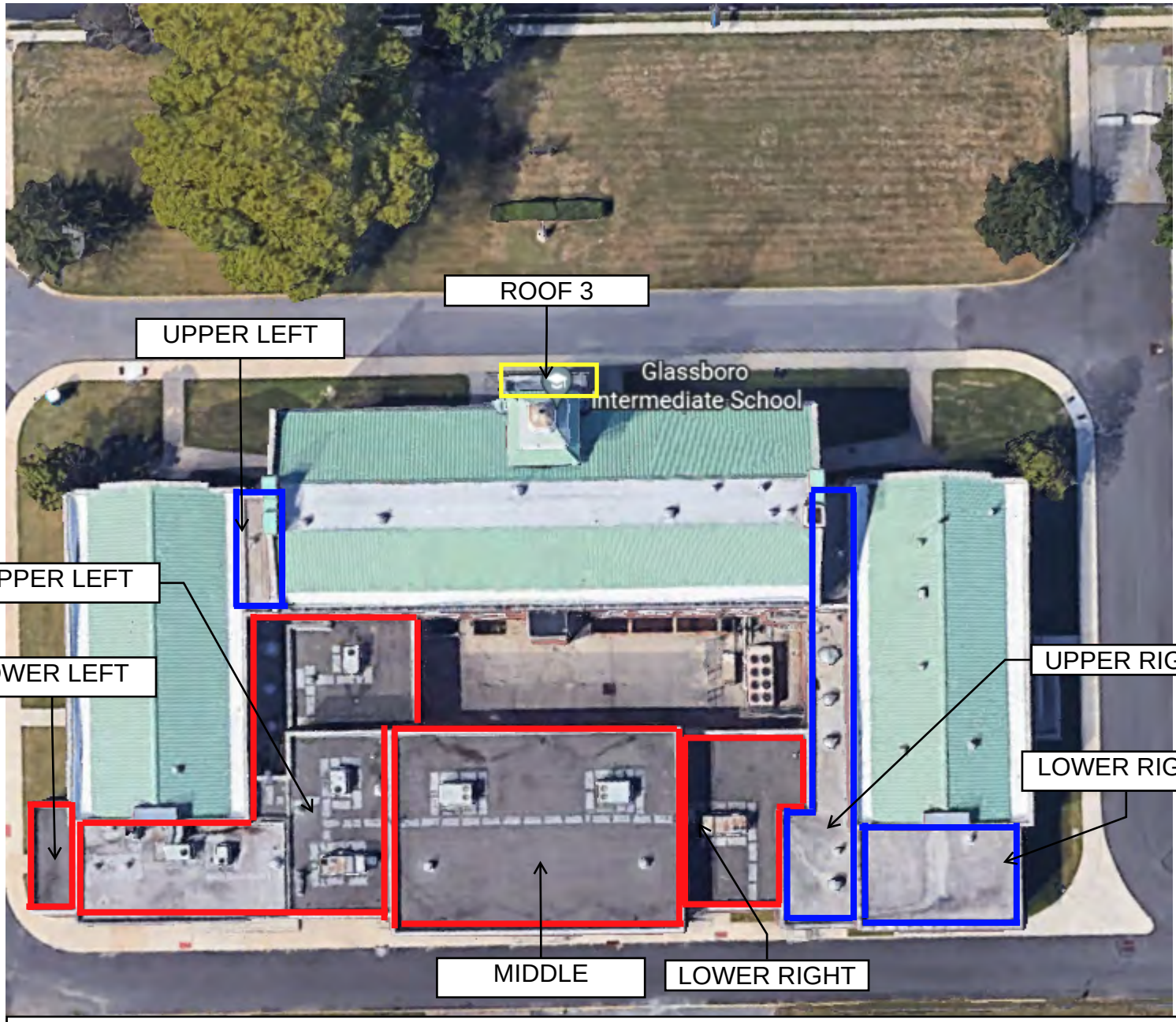
ROOF 2

LOWER RIGHT =

UPPER RIGHT =

UPPER LEFT =

ROOF 3 =



LEGEND

ROOF 1 =

ROOF 2 =

ROOF 3 =

TABLE 1

Asbestos Homogenous Application Table

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
Main Building						
M-01	Pinhole Ceiling Tile	Third Floor Hallway	Good	16000 SF	GIS-1 GIS-2 GIS-3	NAD NAD NAD
M-02	Plaster Joint Compound	Third Floor Hallway	Damaged	1 SF	GIS-4 GIS-5 GIS-6	NAD NAD NAD
S-03	White Plaster	Third Floor	Damaged	35000 SF	GIS-7 GIS-9 GIS-11	NAD NAD NAD
S-04	Brown Plaster	Third Floor	Damaged	35000 SF	GIS-8 GIS-10 GIS-12	NAD NAD NAD
M-05	Green Baseboard	Third Floor Rooms	Damaged	750 LF	GIS-13 GIS-15 GIS-17	NAD* NAD NAD
M-06	Mastic Associated with M-5	Third Floor Rooms	Damaged	750 LF	GIS-14 GIS-16 GIS-18	NAD* NAD NAD
M-07	Green with Specks 12"x12" Floor Tile	Third Floor Rooms	Good	1860 SF	GIS-19 GIS-21 GIS-23	NAD* NAD NAD
M-08	Mastic Associated with M-7	Third Floor Rooms	Good	1860 SF	GIS-20 GIS-22 GIS-24	NAD* NAD NAD
M-09	Gray with Specks 12"x12" Floor Tile	Third Floor Rooms	Good	5000 SF	GIS-25 GIS-27 GIS-29	NAD* NAD NAD
M-10	Mastic Associated with M-9	Third Floor Rooms	Good	5000 SF	GIS-26 GIS-28 GIS-30	NAD NAD* NAD
M-11A	Patch Compound, Lab Split	Third Floor Room 310 and North Stairs	Damaged	250 SF	GIS-31A GIS-32A GIS-33A	NAD NAD NAD
M-11B	Patch Compound, Base Coat, Lab Split	Third Floor Room 310 and North Stairs	Damaged	5 SF	GIS-31B GIS-32B GIS-33B	NAD NAD NAD
M-12	Blue Baseboard	Third Floor Rooms 307 and 308	Good	750 LF	GIS-34 GIS-36 GIS-38	NAD* NAD NAD
M-13	Mastic Associated with M-12	Third Floor Rooms 307 and 308	Good	750 LF	GIS-35 GIS-37 GIS-39	NAD* NAD NAD

MONTROSE ENVIRONMENTAL

Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-14	Blue with Specks 12"x12" Floor Tile	Third Floor Rooms 307 and 308	Good	2000 SF	GIS-40 GIS-42 GIS-44	NAD* NAD NAD
M-15	Mastic Associated with M-14	Third Floor Rooms 307 and 308	Good	2000 SF	GIS-41 GIS-43 GIS-45	NAD* NAD NAD
M-16	Burgandy Fire Caulk	Third Floor North Stairs	Good	50 LF	GIS-46 GIS-47 GIS-48	NAD* NAD NAD
M-17	**Brown/Tan 9"x9" Floor Tile**	**Third Floor Hallway**	**Damaged**	**720 SF**	**GIS-49 GIS-51 GIS-53**	**5.0% Chrysotile 5.3% Chrysotile 5.9% Chrysotile**
M-18	Mastic associated with M-17	Third Floor Hallway	Damaged	720 SF	GIS-50 GIS-52 GIS-54	<0.1 Chrysotile* Insufficient Material Insufficient Material
M-19	Dark Blue 12"x12" Floor Tile	Third Floor Room 305	Good	796 SF	GIS-55 GIS-57 GIS-59	<0.1 Chrysotile* NAD NAD
M-20	Mastic Associated with M-19	Third Floor Room 305	Good	796 SF	GIS-56 GIS-58 GIS-60	NAD* NAD NAD
M-21	Drywall	Third Floor Room 305	Good	35000 SF	GIS-61 GIS-62 GIS-63	NAD NAD NAD
M-22	White with Gray Spots 12"x12" Floor Tile	Third Floor Room 305	Good	1580 SF	GIS-64 GIS-66 GIS-68	NAD* NAD NAD
M-23	Mastic Associated with M-22	Third Floor Room 305	Good	1580 SF	GIS-65 GIS-67 GIS-69	NAD* NAD NAD
M-24	Joint Compound	Third Floor	Good	5000 SF	GIS-70 GIS-71 GIS-72	NAD NAD NAD
M-25	Black Baseboard	Third Floor Stairways	Good	30 LF	GIS-73 GIS-75 GIS-77	NAD* NAD NAD
M-26	Mastic Associated with M-25	Third Floor Stairways	Good	30 LF	GIS-74 GIS-76 GIS-78	NAD* NAD NAD
M-27	Black Tar	Attic	Damaged	10 SF	GIS-79 GIS-80 GIS-81	NAD* NAD NAD
M-28	Black Sheeting	Attic	Damaged	100 SF	GIS-82 GIS-83 GIS-84	NAD* 0.26% Chrysotile 0.26% Chrysotile

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-29	White Caulk	Attic	Damaged	100 SF	GIS-85 GIS-86 GIS-87	NAD* NAD NAD
M-30	Gray Baseboard and Mastic	Third Floor Elevator Area	Good	153 LF	GIS-88 GIS-89 GIS-90	NAD* NAD NAD
M-31	White Floor Tile with Grey Specks 12x12"	2nd Floor Faculty Lounge	Good	696 SF	GIS-91 GIS-93 GIS-95	NAD* NAD NAD
M-32	Mastic Associated with M-31	2nd Floor Faculty Lounge	Good	696 SF	GIS-92 GIS-94 GIS-96	NAD* NAD NAD
M-33A	Blue Baseboard, Lab Split	2nd Floor Faculty Lounge and Room 217	Good	122 LF	GIS-97A GIS-98A GIS-99A	NAD* NAD NAD
M-33B	Mastic, Lab Split	2nd Floor Faculty Lounge and Room 217	Good	122 LF	GIS-97B GIS-98B GIS-99B	NAD* NAD NAD
M-34	Black Baseboard, Lab Split	2nd Floor by Stairwell	Good	250 LF	GIS-100A GIS-101A GIS-102A	NAD* NAD NAD
M-34	Mastic, Lab Split	2nd Floor by Stairwell	Good	250 LF	GIS-100B GIS-101B GIS-102B	NAD* NAD NAD
M-35	Carpet Mastic	Room 219 and 215	Good	918 SF	GIS-103 GIS-104 GIS-105	NAD* NAD NAD
M-36	Drywall Joint Compound	Rooms 219, 217, and 212	Damaged	10000 SF	GIS-106 GIS-107 GIS-108	NAD NAD NAD
M-37	**Black Glue Tar**	**Stair Treads in Stairwells**	**Good**	**2000 SF**	**GIS-109 GIS-110 GIS-111**	**2.6% Chrysotile 2.3% Chrysotile 2.5% Chrysotile**
M-38	Drywall	Rooms 210, 217, and 212	Damaged	1719 SF	GIS-112 GIS-113 GIS-114	NAD NAD NAD
M-39	Pinhole 2x4' Ceiling Tile	217, Hallway Outside 217	Good	5000 SF	GIS-115 GIS-116 GIS-117	NAD NAD NAD
M-40	Dark Blue 12x12" Floor Tile	217 and Outside of Elevator	Good	678 SF	GIS-118 GIS-120 GIS-122	NAD* NAD NAD
M-41	Mastic Associated with M-40	217 and Outside of Elevator	Good	678 SF	GIS-119 GIS-121 GIS-123	NAD* NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
S-42A	Skin Coat, Lab Split	2nd Floor North	Damaged	10000 SF	GIS-124A GIS-125A GIS-126A	NAD NAD NAD
S-43B	Base Coat, Lab Split	2nd Floor North	Damaged	10000 SF	GIS-124B GIS-125B GIS-126B	NAD NAD NAD
S-42C	Plaster joint compound, Lab Split	2nd Floor North	Damaged	10000 SF	GIS-124C GIS-125C GIS-126C	NAD NAD NAD
M-43	Red 12x12" Floor Tile	Rooms 212, 213, and 208	Good	1857 SF	GIS-127 GIS-129 GIS-131	NAD* NAD NAD
M-44	Mastic Associated with M-43	Rooms 212, 213, and 208	Good	1857 SF	GIS-128 GIS-130 GIS-132	NAD* NAD NAD
M-45	Tan Speckled 12x12" Floor Tile	Rooms 212, 213, and 208	Good	1857 SF	GIS-133 GIS-135 GIS-137	NAD* NAD NAD
M-46	Mastic Associated with M-45	Rooms 212, 213, and 209	Good	1857 SF	GIS-134 GIS-136 GIS-138	NAD* NAD NAD
S-47	Plaster - White	Steps Near Stairwell and 217	Damaged	30000 SF	GIS-139 GIS-141 GIS-143	NAD NAD NAD
S-48	Plaster - Brown	Steps Near Stairwell and 218	Damaged	30000 SF	GIS-140 GIS-142 GIS-144	NAD NAD NAD
M-49	Light Blue 12x12" Floor Tile	Rooms 210, 209/211, and 200	Good	2359 SF	GIS-145 GIS-147 GIS-149	NAD* NAD NAD
M-50	Mastic Associated with M-49	Rooms 210, 209/211, and 200	Good	2359 SF	GIS-146 GIS-148 GIS-150	NAD* NAD NAD
M-51A	Red Baseboard, Lab Split	Rooms 210, 209/211, and 201	Good	2359 LF	GIS-151A GIS-152A GIS-153A	NAD* NAD NAD
M-51B	Mastic, Lab Split	Rooms 210, 209/211, and 202	Good	2359 LF	GIS-151B GIS-152B GIS-153B	NAD* NAD NAD
M-52	Plaster - White	Bathroom, Stairwell across bathroom, end of hall	Damaged	30000 SF	GIS-154 GIS-156 GIS-158	NAD NAD NAD
M-53	Plaster - Brown	Bathroom, Stairwell across bathroom, end of hall	Damaged	30000 SF	GIS-155 GIS-157 GIS-159	NAD NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-54	Black Counters	Rooms 219, 200, and 201	Good	576 SF	GIS-160 GIS-161 GIS-162	NAD NAD NAD
M-55	Lineoleum Black Traction Tread	Hallyway South to Stairs and Stairs	Good	150 SF	GIS-163 GIS-165 GIS-167	NAD* NAD NAD
M-56	Mastic Associated with M-55	Hallyway South to Stairs and Stairs	Good	150 SF	GIS-164 GIS-166 GIS-168	NAD* NAD NAD
M-57	Pinhole and Circular Crater 2x4' White Ceiling Tile	Room 215	Good	222 SF	GIS-169 GIS-170 GIS-171	NAD NAD NAD
M-58	Pinhole and Oblong Crater 2x4' White Ceiling Tile	Room 215	Good	222 SF	GIS-172 GIS-173 GIS-174	NAD NAD NAD
M-59	Black Sink Under Coating	Room 217	Good	75 SF	GIS-175 GIS-176 GIS-177	NAD* NAD NAD
M-60A	Dark Red Baseboard, Lab Split	Room 202 and 200	Damaged	2212 LF	GIS-178A GIS-179A GIS-180A	NAD* NAD NAD
M-60B	Mastic, Lab Split	Room 202 and 200	Damaged	2212 LF	GIS-178B GIS-179B GIS-180B	NAD* NAD NAD
M-61A	Dark Blue Baseboard, Lab Split	Room 201 and South Hallway	Good	1120LF	GIS-181A GIS-182A GIS-183A	NAD* NAD NAD
M-61B	Mastic, Lab Split	Room 201 and South Hallway	Good	1120 LF	GIS-181B GIS-182B GIS-183B	NAD* NAD NAD
M-62	White Floor Tile with Grey Specks 12x12"	Room 201, 200, and 202	Good	2212 SF	GIS-184 GIS-186 GIS-188	NAD* NAD NAD
M-63	Mastic Associated with M-62	Room 201, 200, and 202	Good	2212 SF	GIS-185 GIS-187 GIS-189	NAD* NAD Insufficient Material
M-64	Red 12x12" Floor Tile	Room 201	Good	1120 SF	GIS-190 GIS-192 GIS-194	NAD* NAD NAD
M-65	Mastic Associated with M-64	Room 201	Good	1120 SF	GIS-191 GIS-193 GIS-195	NAD* NAD NAD
M-66	Drywall	Room 200, 201, and 202	Good	5000 SF	GIS-196 GIS-197 GIS-198	NAD NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-67	Drywall Joint Compound	Room 200, 201, and 202	Good	4500 SF	GIS-199 GIS-200 GIS-201	NAD NAD NAD
M-68	Light Blue 12x12" Floor Tile	Room 200	Good	1092 SF	GIS-202 GIS-204 GIS-206	NAD* NAD NAD
M-69	Floor Leveling Associated with M-68	Room 200	Good	1092 SF	GIS-203 GIS-205 GIS-207	NAD* NAD NAD
M-70	Hood Backing	Room 200 Prep Room	Good	50 SF	GIS-208 GIS-209 GIS-210	NAD* NAD NAD
M-71A	Dark Blue Stair Tread, Lab Split	South Stairs	Good	6500 SF	GIS-211A GIS-212A GIS-213A	NAD* NAD NAD
M-71B	Mastic, Lab Split	South Stairs	Good	6500 SF	GIS-211B GIS-212B GIS-213B	NAD* NAD NAD
M-72	Dark Blue 12x12" Floor Tile	1st Level by Room 114	Damaged	451 SF	GIS-214 GIS-216 GIS-218	NAD* NAD NAD
M-73	Mastic Associated with M-72	1st Level by Room 114	Damaged	451 SF	GIS-215 GIS-217 GIS-219	NAD* NAD NAD
M-74	White Floor Tile with Grey Specks 12x12"	1st Level by Room 114	Damaged	451 SF	GIS-220 GIS-222 GIS-224	NAD* NAD NAD
M-75	Mastic Associated with M-74	1st Level by Room 114	Damaged	451 SF	GIS-221 GIS-223 GIS-225	NAD* NAD NAD
M-76A	Red Baseboard, Lab Split	Room 114	Damaged	200 LF	GIS-226A GIS-227A GIS-228A	NAD* NAD NAD
M-76B	Mastic, Lab Split	Room 114	Damaged	200 LF	GIS-226B GIS-227B GIS-228B	NAD* NAD NAD
M-77A	Blue Baseboard, Lab Split	Hallway Outside Library, Library	Damaged	4000 LF	GIS-229A GIS-230A GIS-231A	NAD* NAD NAD
M-77B	Mastic, Lab Split	Hallway Outside Library, Library	Damaged	4000 LF	GIS-229B GIS-230B GIS-231B	NAD* NAD NAD
M-78	Carpet Mastic	Library and Room 114	Good	5500 SF	GIS-232 GIS-233 GIS-234	NAD* NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
S-79	White Plaster	Library, Hallway outside Library, Closet across 114	Damaged	35000 SF	GIS-235 GIS-237 GIS-239	NAD NAD NAD
S-80	Brown Plaster	Library, Hallway outside Library, Closet across 114	Damaged	35000 SF	GIS-236 GIS-238 GIS-240	NAD NAD NAD
M-81	Drywall	Inside storage near 116, and Rooms 116 and 114	Good	30000 SF	GIS-241 GIS-242 GIS-243	NAD NAD NAD
M-82	White Pinhole 2'x4' Ceiling Tile	Hallway Outside Library	Good	15000 SF	GIS-244 GIS-245 GIS-246	NAD NAD NAD
M-83	Pinhole with Small Circular Crater White 2'x4' Ceiling Tile	Inside storage near 116, hall outside storage, outside 114	Good	8000 SF	GIS-247 GIS-248 GIS-249	NAD NAD NAD
M-84	Spray-On Insulation	Inside both maintenance closets in library hallway	Good	32000 SF	GIS-250 GIS-253 GIS-256 GIS-251 GIS-254 GIS-252 GIS-255	NAD for all
M-85	Black Window Ledge	Corridor before gym north and south	Damaged	20 LF	GIS-257 GIS-258 GIS-259	NAD NAD NAD
M-86	Tan Color Speckled 12x12" Floor Tile	Office 110 in locker room and office 111 in girls locker room	Damaged	300 SF	GIS-260 GIS-262 GIS-264	NAD* NAD NAD
M-87	Mastic Associated with M-86	Office 110 in locker room and office 111 in girls locker room	Damaged	300 SF	GIS-261 GIS-263 GIS-265	NAD* NAD NAD
M-88	Joint Compound	Room 114, across 114 storage near 116	Damaged	10000 SF	GIS-266 GIS-267 GIS-268	NAD NAD NAD
S-89	White Plaster	North stairwell area	Damaged	10000 SF	GIS-269 GIS-271 GIS-273	NAD NAD NAD
S-90	Brown Plaster	North stairwell area	Damaged	10000 SF	GIS-270 GIS-272 GIS-274	NAD NAD NAD
M-91	Red 12x12" Floor Tile	Room 109	Good	614 SF	GIS-275 GIS-277 GIS-279	NAD* NAD NAD
M-92	Mastic Associated with M-91	Room 109	Good	614 SF	GIS-276 GIS-278 GIS-280	NAD* NAD NAD
M-93A	Red Baseboard, Lab Split	Room 109	Good	200 LF	GIS-281A GIS-282A GIS-283A	NAD* NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-93B	Mastic, Lab Split	Room 109	Good	200 LF	GIS-281B GIS-282B GIS-283B	NAD* NAD NAD
M-94	Dark Green with Colored Specks 12"x12" Floor Tile	Room 107	Good	641 SF	GIS-284 GIS-286 GIS-288	NAD* NAD NAD
M-95	Mastic Associated with M-94	Room 107	Good	641 SF	GIS-285 GIS-287 GIS-289	NAD* NAD NAD
M-96A	Green Baseboard, Lab Split	Room 107	Good	200 LF	GIS-290A GIS-291A GIS-292A	NAD* NAD NAD
M-96B	Mastic, Lab Split	Room 107	Good	200 LF	GIS-290B GIS-291B GIS-292B	NAD* NAD NAD
M-97A	Black Baseboard, Lab Split	Near Stairways	Good	100 LF	GIS-293A GIS-294A GIS-295A	NAD* NAD NAD
M-97B	Mastic, Lab Split	Near Stairways	Good	100 LF	GIS-293B GIS-294B GIS-295B	NAD* NAD NAD
M-98	Light Green with Colored Specks 12"x12" Floor Tile	Room 110-1, Principals Office, and Staffing Dining	Good	1200 SF	GIS-296 GIS-298 GIS-300	NAD* NAD NAD
M-99	Mastic associated with M-98	Room 110-1, Principals Office, and Staffing Dining	Good	1200 SF	GIS-297 GIS-299 GIS-301	NAD* NAD NAD
M-100A	Burgundy Baseboard, Lab Split	Main Office	Good	200 SF	GIS-302A GIS-303A GIS-304A	NAD* NAD NAD
M-100B	Mastic, Lab Split	Main Office	Good	200 SF	GIS-302B GIS-303B GIS-304B	NAD* NAD NAD
M-101	Tan with Colored Specks 12"x12" Floor Tile	Rooms 109, 107, and 105	Good	2200 SF	GIS-305 GIS-307 GIS-309	NAD* NAD NAD
M-102	Mastic associated with M-101	Rooms 109, 107, and 105	Good	2200 SF	GIS-306 GIS-308 GIS-310	Insufficient Material NAD* Insufficient Material
M-103	Yellow Carpet Mastic	Main Office	Good	917 SF	GIS-311 GIS-312 GIS-313	NAD* NAD NAD
M-104	Pinhole 2'x4' White Ceiling Tile	North stairwell, South stairwell, Room 107	Good	35000 SF	GIS-314 GIS-315 GIS-316	NAD NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-105	White with Specks 12"x12" Floor Tile	Elevator Area, Level 1	Good	153 SF	GIS-317 GIS-319 GIS-321	NAD* NAD NAD
M-106	Mastic Associated with M-105	Elevator Area, Level 1	Good	153 SF	GIS-318 GIS-320 GIS-322	NAD* NAD NAD
M-107	Dark Blue with Specks 12"x12" Floor Tile	Elevator Area, Level 1	Good	153 SF	GIS-323 GIS-325 GIS-327	NAD* NAD NAD
M-108	Mastic associated with M-107	Elevator Area, Level 1	Good	153 SF	GIS-324 GIS-326 GIS-328	NAD* NAD NAD
S-109	White Plaster	South stairwell, Room 105, and Room 109	Damaged	40000 SF	GIS-329 GIS-331 GIS-333	NAD NAD NAD
S-110	Brown Plaster	South stairwell, Room 105, and Room 109	Damaged	40000 SF	GIS-330 GIS-332 GIS-334	NAD NAD NAD
M-111	Drywall	Room 105, Main Office, and Room 109	Good	25000 SF	GIS-335 GIS-336 GIS-337	NAD NAD NAD
M-112	12"x12" Pink Floor Tile	Nurse Room 106	Good	768 SF	GIS-338 GIS-340 GIS-342	NAD* NAD NAD
M-113	Mastic associated with M-112	Nurse Room 106	Good	768 SF	GIS-339 GIS-341 GIS-343	NAD* NAD NAD
M-114	Black Sink Under Coating	Nurse Room 106	Good	25 SF	GIS-344 GIS-345 GIS-346	NAD* NAD NAD
M-115	Light Green with White Specks 12"x12" Floor Tile	Nurse Room 106	Good	768 SF	GIS-347 GIS-349 GIS-351	NAD* NAD NAD
M-116	Mastic Associated with M-115	Nurse Room 106	Good	768 SF	GIS-348 GIS-350 GIS-352	NAD* NAD NAD
M-117	White 12"x12" Floor with Green Specks	Nurse Room 106	Good	768 SF	GIS-353 GIS-355 GIS-357	NAD* NAD NAD
M-118	Mastic Associated with M-117	Nurse Room 106	Good	768 SF	GIS-354 GIS-356 GIS-358	NAD* NAD NAD
M-119	Joint Compound	South Staircase, Room 105, and near elevator	Damaged	12000 SF	GIS-359 GIS-360 GIS-361	NAD NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-120	Dark Yellow Carpet Mastic	Room 103	Good	246 SF	GIS-362 GIS-363 GIS-364	NAD* NAD NAD
S-121	White Spray Insulation	Room 103 Ceiling	Good	3000 SF	GIS-365 GIS-368 GIS-371 GIS-366 GIS-369 GIS-367 GIS-370	NAD for all
M-122	Beige 12"x12" Speckled Floor Tile	Cafeteria	Good	3388 SF	GIS-372 GIS-374 GIS-376	NAD* NAD NAD
M-123	Mastic Associated with M-122	Cafeteria	Good	3388 SF	GIS-373 GIS-375 GIS-377	NAD* NAD NAD
M-124	Red 12x12" Floor Tile	Cafeteria	Good	3388 SF	GIS-378 GIS-380 GIS-382	NAD* NAD NAD
M-125	Mastic Associated with M-124	Cafeteria	Good	3388 SF	GIS-379 GIS-381 GIS-383	NAD* NAD NAD
M-126	Green 12"x12" Floor Tile	Cafeteria	Good	3388 SF	GIS-384 GIS-386 GIS-388	NAD* NAD NAD
M-127	Mastic Associated with M-126	Cafeteria	Good	3388 SF	GIS-385 GIS-387 GIS-389	NAD* NAD NAD
M-128	Blue 12"x12" Floor Tile	Cafeteria	Good	3388 SF	GIS-390 GIS-392 GIS-394	NAD* NAD NAD
M-129	Mastic Associated with M-128	Cafeteria	Good	3388 SF	GIS-391 GIS-393 GIS-395	NAD* NAD NAD
M-130A	Blue Baseboard, Lab Split	Cafeteria	Good	3388 SF	GIS-396A GIS-397A GIS-398A	NAD* NAD NAD
M-130B	Mastic, Lab Split	Cafeteria	Good	3388 SF	GIS-396B GIS-397B GIS-398B	NAD* NAD NAD
M-131A	Blue Baseboard, Lab Split	Cafeteria Hallway	Good	700 LF	GIS-399A GIS-400A GIS-401A	NAD* NAD NAD
M-131B	Mastic, Lab Split	Cafeteria Hallway	Good	700 LF	GIS-399B GIS-400B GIS-401B	NAD* NAD NAD
M-132	Teal 12"x12" Linoleum Floor Tile	Back Entrance Ramp	Good	251 SF	GIS-402 GIS-404 GIS-406	NAD* NAD NAD

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-133	Mastic Associated with M-132	Back Entrance Ramp	Good	251 SF	GIS-403 GIS-405 GIS-407	NAD NAD* NAD
M-134	White with Specks 12"x12" Floor Tile	Back Entrance	Good	95 SF	GIS-408 GIS-410 GIS-412	NAD* NAD NAD
M-135	Mastic Associated with M-134	Back Entrance	Good	95 SF	GIS-409 GIS-411 GIS-413	NAD* NAD NAD
M-136	White 2'x2' Pinhole Ceiling Tile	Cafeteria Hallway	Good	5000 SF	GIS-414 GIS-415 GIS-416	NAD NAD NAD
M-137	White 2'x4' Pinhole Ceiling Tile	Cafeteria Hallway	Good	5000 SF	GIS-417 GIS-418 GIS-419	NAD NAD NAD
M-138	Tan Carpet Mastic	Room 100	Good	1272 SF	GIS-420 GIS-421 GIS-422	NAD* NAD NAD
M-139	Gray Boiler Insulation 1	Basement by Street	Good	100 SF	GIS-423 GIS-424 GIS-425	NAD NAD NAD
M-140	Gray Boiler Insulation 2	Basement by Street	Good	100 SF	GIS-426 GIS-427 GIS-428	NAD NAD NAD
M-141	Red Boiler Caulk	Basement by Street	Good	20 LF	GIS-429 GIS-430 GIS-431	NAD* NAD NAD
M-142	Gray Spray-On Insulation	Basement by Back-Street	Good	241 SF	GIS-432 GIS-435 GIS-438 GIS-433 GIS-436 GIS-434 GIS-437	NAD for all
M-143	**Brown 9"x9" Floor Tile**	**Basement first room on right**	**Damaged**	**494 SF**	**GIS-439 GIS-441 GIS-443**	**3.0% Chrysotile 3.0% Chrysotile 4.4% Chrysotile**
M-144	**Mastic Associated with M143**	**Basement first room on right**	**Damaged**	**494 SF**	**GIS-440 GIS-442 GIS-444**	**0.41% Chrysotile* 0.40% Chrysotile 0.37% Chrysotile**
M-145	Fire Caulk	Emergency Fire Exit	Good	50 LF	GIS-445 GIS-446	NAD* NAD
M-146	Debris from Crawlspace	Crawl Space with Asbestos Hazard Sign	Damaged	100 SF	GIS-448 GIS-449 GIS-450	NAD NAD NAD
P-1	**Pipe Insulation/Elbows**	**Possibly Behind Fixed Walls**	**Unknown**	**Unknown**	**Not Sampled**	**Presumed ACM**

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Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
P-2	**Wire Insulation**	**Possibly Behind Fixed Walls**	**Unknown**	**Unknown**	**Not Sampled**	**Presumed ACM**
Roofing Systems						
M-01	Black Mats	Roof 1 Lower Right	Damaged	8 SF ea. (~70 total)	GISR-1 GISR-2 GISR-3	NAD* NAD NAD
M-02	Silver Roof Liner	Roof 1 Lower Right	Good	195 LF	GISR-4 GISR-5 GISR-6	NAD* NAD NAD
M-03A	Roof Core - Roofing	Roof 1 Lower Right	Good	2012 SF	GISR-7A	NAD*
M-03B	Roof Core -Tar, Lab Split	Roof 1 Lower Right	Good	2012 SF	GISR-7B	NAD*
M-03C	Roof Core -Tar Felt	Roof 1 Lower Right	Good	2012 SF	GISR-7C	NAD*
M-03D	Roof Core -Tar Paper	Roof 1 Lower Right	Good	2012 SF	GISR-7D	NAD*
M-03E	Roof Core - Insulation	Roof 1 Lower Right	Good	2012 SF	GISR-7E	NAD
M-03F	Roof Core -Foam	Roof 1 Lower Right	Good	2012 SF	GISR-7F	NAD
M-04	HVAC Skirt	Roof 1 Lower Right	Good	41 LF ea. (~8 total)	GISR-8 GISR-9 GISR-10	NAD* NAD NAD
M-05	Tar	Roof 1 Middle Near Drain	Damaged	2 SF ea. (~10 total)	GISR-11 GISR-12 GISR-13	NAD* NAD NAD
M-03F	Roof Core - Roofing	Roof 1 Middle	Good	8091 SF	GISR-14A	NAD
M-03G	Roof Core -Tar	Roof 1 Middle	Good	8091 SF	GISR-14B	NAD
M-03H	Roof Core -Tar Felt	Roof 1 Middle	Good	8091 SF	GISR-14C	NAD

MONTROSE ENVIRONMENTAL

Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-03I	Roof Core -Tar Paper	Roof 1 Middle	Good	8091 SF	GISR-14D	NAD
M-03J	Roof Core - Membrane	Roof 1 Middle	Good	8091 SF	GISR-14E	NAD*
M-03K	Roof Core - Insulation	Roof 1 Middle	Good	8091 SF	GISR-14F	NAD
M-03L	Roof Core -Foam	Roof 1 Middle	Good	8091 SF	GISR-14G	NAD
M-06	Metal Coating on Pipe	Roof 1 Middle	Good	1 LF ea. (~ 10 total)	GISR-15 GISR-16 GISR-17	NAD* NAD NAD
M-07	**Tar**	**Roof 1 Middle on Ledge**	**Good**	**70 LF**	**GISR-18 GISR-19 GISR-20**	**3.0% Chrysotile NAD NAD**
M-08	**Copper Flashing Mastic**	**Roof 1 Upper Left**	**Damaged**	**195 LF**	**GISR-21 GISR-22 GISR-23**	**NAD* 5.3% Chrysotile NAD**
M-09	Tar	Roof 1 Upper Left	Good	195 LF	GISR-24A	0.46% Chrysotile*
M-09A	**Sealant**	**Roof 1 Upper Left**	**Good**	**195 LF**	**GISR-24B**	**8.2% Chrysotile**
M-09B	**Tar**	**Roof 1 Upper Left**	**Good**	**195 LF**	**GISR-25**	**2.3% Chrysotile**
M-09C	Tar	Roof 1 Upper Left	Good	195 LF	GISR-26A	NAD
M-09D	Sealant	Roof 1 Upper Left	Good	195 LF	GISR-26B	NAD
M-0M	Roof Core - Roofing	Roof 1 Lower Left	Good	590 SF	GISR-27A	NAD
M-03N	Roof Core -Tar	Roof 1 Lower Left	Good	590 SF	GISR-27B	NAD
M-03O	Roof Core -Tar Felt	Roof 1 Lower Left	Good	590 SF	GISR-27C	NAD

MONTROSE ENVIRONMENTAL

Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-03P	Roof Core -Tar Paper	Roof 1 Lower Left	Good	590 SF	GISR-27D	NAD
M-03Q	Roof Core - Insulation	Roof 1 Lower Left	Good	590 SF	GISR-27E	NAD
M-03R	Roof Core -Foam	Roof 1 Lower Left	Good	595 SF	GISR-27F	NAD
M-10	Black Caulk	Roof 1 Lower Left	Damaged	109 LF	GISR-28 GISR-29 GISR-30	NAD* NAD NAD
M-11	**White Caulk**	**Roof 1 Lower Left**	**Damaged**	109 LF	**GISR-31** **GISR-32** **GISR-33**	**2.8% Chrysotile** **NAD** **NAD**
M-12	White Caulk	Roof 2 Lower Right	Good	109 LF	GISR-34 GISR-35 GISR-36	NAD* NAD NAD
M-13	**Black Caulk**	**Roof 2 Lower Right**	**Good**	109 LF	**GISR-37** **GISR-38** **GISR-39**	**6.9% Chrysotile** **NAD** **NAD**
M-14A	Roof Core - Roofing	Roof 2 Lower Right	Good	1766 SF	GISR-40A	NAD
M-14B	Roof Core -Tar	Roof 2 Lower Right	Good	1766 SF	GISR-40B	0.21% Chrysotile*
M-14C	Roof Core -Tar Felt	Roof 2 Lower Right	Good	1766 SF	GISR-40C	NAD
M-14D	Roof Core - Insulation	Roof 2 Lower Right	Good	1766 SF	GISR-40D	NAD
M-15	**Black Mastic**	**Roof 2 Upper Right**	**Good**	**331 LF**	**GISR-41** **GISR-42** **GISR-43**	**6.7% Chrysotile*** **3.5% Chrysotile** **NAD**
M-14E	Roof Core - Roofing	Roof 2 Upper Right	Good	2034 SF	GISR-44A	0.17% Chrysotile*
M-14F	**Roof Core - Tar Felt**	**Roof 2 Upper Right**	**Good**	2034 SF	**GISR-44B**	**2.4% Chrysotile***
M-14G	**Roof Core - Tar Paper**	**Roof 2 Upper Right**	**Good**	2034 SF	**GISR-44C**	**1.1 % Chrysotile**

MONTROSE ENVIRONMENTAL

Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-14H	Roof Core -Tar	Roof 2 Upper Right	Good	2034 SF	GISR-44D	<0.1% Chrysotile*
M-14I	Roof Core - Insulation	Roof 2 Upper Right	Good	2034 SF	GISR-44E	NAD
M-16	**Black Tar Sealant**	**Roof 2 Upper Left**	**Good**	**98 LF**	**GISR-45 GISR-46 GISR-47**	**6.1 % Chrysotile* 2.7 % Chrysotile NAD**
M-14J	Roof Core - Roofing	Roof 2 Lower Right	Good	1766 SF	GISR-48A	NAD
M-14K	Roof Core -Tar Felt	Roof 2 Lower Right	Good	1766 SF	GISR-48B	NAD
M-14L	Roof Core -Tar	Roof 2 Lower Right	Good	1766 SF	GISR-48C	NAD
M-14M	Roof Core - Insulation	Roof 2 Lower Right	Good	1766 SF	GISR-48D	NAD
M-17A	Roof Core - Roofing	Roof 3	Good	286 SF	GISR-49A	<0.19% Chrysotile*
M-17B	Roof Core -Tar Felt	Roof 3	Good	286 SF	GISR-49B	NAD*
M-17C	Roof Core -Tar	Roof 3	Good	286 SF	GISR-49C	NAD*
M-17E	Roof Core - Roofing	Roof 3	Good	286 SF	GISR-50A	NAD
M-17F	Roof Core -Tar Felt	Roof 3	Good	286 SF	GISR-50B	NAD
M-17G	Roof Core -Tar Paper	Roof 3	Good	286 SF	GISR-50C	<0.1% Chrysotile
M-17H	Roof Core -Tar	Roof 3	Good	286 SF	GISR-50D	<0.25% Chrysotile
M-17I	Roof Core - Insulation	Roof 3	Good	286 SF	GISR-50E	NAD

Table 1
Asbestos Homogeneous Area Table
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Homogeneous Application	Material	Location	Condition	Quantity	Sample ID	Analytical Result
M-17J	Roof Core -Foam	Roof 3	Good	286 SF	GISR-50F	NAD
M-14N	Roof Core - Roofing	Roof 2 Upper Left	Good	343 SF	GISR-51A	NAD
M-14O	Roof Core -Tar	Roof 2 Upper Left	Good	343 SF	GISR-51B	<0.25% Chrysotile
M-14P	Roof Core - Insulation	Roof 2 Upper Left	Good	343 SF	GISR-51C	NAD

Key

NAD= No asbestos detected

NAD*= No asbestos detected, confirmed via TEM

SF= Square feet

*= Determined via TEM

LF= Linear feet

= Confirmed ACM

TABLE 2

XRF Testing Results

MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/28/2022	1	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.01	0.1
7/28/2022	2	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.07	0.1
7/28/2022	3	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.04	0.1
7/28/2022	4	3rd Fl Hallway	Wall	Plaster	Beige	Intact	Negative	0.11	0.06
7/28/2022	5	3rd Fl Hallway	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
7/28/2022	6	3rd Fl Hallway	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
7/28/2022	7	3rd Fl Hallway	Wall	Plaster	Beige	Intact	Negative	0.1	0.03
7/28/2022	8	3rd Fl Hallway	Floor	Painted Tiles	Gray	Intact	Negative	<LOD	0.01
7/28/2022	9	3rd Fl Hallway	Baseboard	Concrete	Gray	Intact	Negative	0.14	0.07
7/28/2022	10	3rd Fl Hallway	Window Frame	Wood	Beige	Intact	Inconclusive	0.99	0.1
7/28/2022	11	3rd Fl Hallway	Window Frame	Wood	Beige	Intact	Negative	0.78	0.1
7/28/2022	12	3rd Fl Hallway	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.01
7/28/2022	13	3rd Fl Hallway	Window Sill	Wood	Beige	Intact	Inconclusive	0.95	0.15
7/28/2022	**14**	**3rd Fl Hallway**	**Window Sill**	**Wood**	**Beige**	**Fair**	**Positive**	**1.55**	**0.28**
7/28/2022	15	3rd Fl Hallway	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.01
7/28/2022	16	3rd Fl Hallway	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.01
7/28/2022	17	310	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
7/28/2022	18	310	Wall	Concrete	Beige	Intact	Negative	0.02	0.01
7/28/2022	19	310	Wall	Concrete	Beige	Intact	Negative	0.1	0.03
7/28/2022	20	310	Wall	Concrete	Beige	Intact	Negative	0.04	0.01
7/28/2022	21	310	Shelving	Wood	Beige	Intact	Negative	0.09	0.04
7/28/2022	22	310	Chalkboard	Wood	Beige	Intact	Negative	0.06	0.02
7/28/2022	23	310	Chalkboard	Wood	Beige	Intact	Negative	0.04	0.01
7/28/2022	24	310	Baseboard	Wood	Beige	Intact	Negative	0.02	0.01
7/28/2022	25	Stairwell North	Wall	Plaster	Yellow	Intact	Negative	0.03	0.01
7/28/2022	26	Stairwell North	Wall	Plaster	Yellow	Intact	Negative	0.05	0.01
7/28/2022	27	Stairwell North	Wall	Plaster	Yellow	Intact	Negative	<LOD	0.01
7/28/2022	**28**	**Stairwell North**	**Wall**	**Plaster**	**Yellow**	**Fair**	**Positive**	**1.65**	**0.23**

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MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/28/2022	29	Stairwell North	Wall	Plaster	Yellow	Intact	Negative	0.03	0.01
7/28/2022	30	Stairwell North	Newel Post	Metal	Black	Intact	Inconclusive	0.93	0.1
7/28/2022	**31**	**Stairwell North**	**Newel Post**	**Metal**	**Black**	**Fair**	**Positive**	**1.16**	**0.1**
7/28/2022	32	Stairwell North	Railing	Metal	Black	Intact	Negative	<LOD	0.01
7/28/2022	33	Stairwell North	Railing	Metal	Black	Intact	Negative	0.33	0.1
7/28/2022	34	Stairwell North	Stringer	Metal	Black	Intact	Inconclusive	1.07	0.1
7/28/2022	**35**	**Stairwell North**	**Stringer**	**Metal**	**Black**	**Fair**	**Positive**	**1.64**	**0.18**
7/28/2022	36	Stairwell North	Riser	Metal	Gray	Intact	Inconclusive	0.9	0.1
7/28/2022	37	Stairwell North	Riser	Metal	Gray	Intact	Inconclusive	0.86	0.1
7/28/2022	38	Stairwell North	Riser	Metal	Gray	Intact	Negative	0.7	0.1
7/28/2022	39	Stairwell North	Tread	Metal	Gray	Intact	Negative	0.26	0.09
7/28/2022	40	Stairwell North	Tread	Metal	Black	Intact	Negative	0.11	0.04
7/28/2022	41	Stairwell North Top Str	Paneling	Wood	Beige	Intact	Negative	0.26	0.04
7/28/2022	42	Stairwell North Top Str	Window Frame	Wood	Beige	Intact	Negative	0.24	0.04
7/28/2022	43	Stairwell North Top Str	Window Sash	Wood	Beige	Intact	Negative	0.33	0.1
7/28/2022	44	Stairwell North Top Str	Window Sill	Wood	Beige	Intact	Negative	0.23	0.05
7/28/2022	45	Stairwell North Top Storage	Wall	Plaster	Beige	Intact	Negative	0.32	0.1
7/28/2022	46	307	Wall	Plaster	Beige	Intact	Negative	0.58	0.1
7/28/2022	47	307	Wall	Plaster	Beige	Intact	Negative	0.25	0.04
7/28/2022	48	307	Wall	Plaster	Beige	Intact	Negative	0.52	0.1
7/28/2022	49	307	Wall	Plaster	Beige	Intact	Negative	0.55	0.1
7/28/2022	50	307	Door Frame	Metal	Blue	Intact	Negative	0.17	0.01
7/28/2022	51	307	Door Jamb	Metal	Blue	Intact	Negative	0.14	0.01
7/28/2022	52	Calibration	Red Film	Film	Red		Positive	1.64	0.1
7/28/2022	53	Calibration	Red Film	Film	Red		Positive	1.69	0.1
7/28/2022	54	Calibration	Red Film	Film	Red		Positive	2.05	0.1
7/28/2022	55	Standardization					PASS		
7/28/2022	56						NULL		

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MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/28/2022	57	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.08	0.1
7/28/2022	58	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.04	0.1
7/28/2022	59	Calibration	Red Film	Film	Red	Intact	Positive	1.19	0.1
7/28/2022	60	305	Wall	Plaster	Beige	Intact	Negative	0.03	0.02
7/28/2022	61	305	Wall	Plaster	Beige	Intact	Negative	<LOD	0.03
7/28/2022	62	305	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
7/28/2022	63	305	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
7/28/2022	64	305	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/28/2022	65	305	Window Frame	Wood	Beige	Intact	Negative	0.43	0.1
7/28/2022	66	305	Window Sill	Wood	Beige	Intact	Inconclusive	0.94	0.1
7/28/2022	67	305	Window Sill	Wood	Beige	Intact	Negative	0.59	0.1
7/28/2022	68	305	Window Trim	Wood	Beige	Intact	Negative	0.09	0.02
7/28/2022	69	306	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.02
7/28/2022	70	306	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.01
7/28/2022	71	306	Window Frame	Wood	Beige	Intact	Negative	0.31	0.1
7/28/2022	72	306	Window Sill	Wood	Beige	Intact	Negative	0.34	0.1
7/28/2022	73	306	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.02
7/28/2022	74	306	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.03
7/28/2022	75	306	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.04
7/28/2022	76	306	Window Sill	Wood	Beige		Negative	0.04	0.02
7/28/2022	77	Calibration	Red Film	Film	Red		Inconclusive	1.05	0.1
7/28/2022	78	Calibration	Red Film	Film	Red		Inconclusive	1.15	0.1
7/28/2022	79	Calibration	Red Film	Film	Red		Inconclusive	1.05	0.1
7/28/2022	80	Standardization					PASS		
7/28/2022	81	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.14	0.1
7/28/2022	82	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.07	0.1
7/28/2022	83	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.06	0.1
7/28/2022	84	306	Door Frame	Wood	Aqua	Intact	Negative	<LOD	0.02

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MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/28/2022	85	306	Door Cover	Drywall	Beige	Intact	Negative	<LOD	0.01
7/28/2022	86	3rd Fl Elevator Hall	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.04
7/28/2022	87	3rd Fl Elevator Hall	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.01
7/28/2022	88	3rd Fl Elevator Hall	Door	Metal	Blue	Intact	Negative	<LOD	0.01
7/28/2022	89	3rd Fl Elevator Hall	Wall	Drywall	White	Intact	Negative	<LOD	0.02
7/28/2022	90	3rd Fl Elevator Hall	Wall	Drywall	White	Intact	Negative	<LOD	0.01
7/28/2022	91	3rd Fl Elevator Hall	Wall	Concrete	White	Intact	Negative	<LOD	0.01
7/28/2022	92	3rd Fl Elevator Hall	Wall	Drywall	White	Intact	Negative	<LOD	0.05
7/28/2022	93	303	Shelving	Wood	White	Intact	Negative	<LOD	0.03
7/28/2022	94	303	Shelving	Wood	White	Intact	Negative	0.02	0.01
7/28/2022	95	303	Shelving	Wood	White	Intact	Negative	0.02	0.01
7/28/2022	96	303	Shelving	Wood	White	Intact	Negative	<LOD	0.03
7/28/2022	97	301	Window Frame	Wood	Beige	Fair	Inconclusive	1.07	0.1
7/28/2022	98	301	Window Frame	Wood	Beige	Fair	Inconclusive	1.01	0.1
7/28/2022	**99**	**301**	**Window Frame**	**Wood**	**Beige**	**Fair**	**Positive**	**1.5**	**0.17**
7/28/2022	**100**	**301**	**Window Sill**	**Wood**	**Beige**	**Fair**	**Positive**	**1.5**	**0.18**
7/28/2022	101	3rd Fl Hallway	Window Sill	Wood	Beige	Intact	Inconclusive	1.23	0.16
7/28/2022	102	3rd Fl Hallway	Window Sill	Wood	Beige	Intact	Inconclusive	1.04	0.15
7/28/2022	103	3rd Fl Hallway	Window Sill	Wood	Beige	Intact	Negative	0.39	0.1
7/28/2022	104	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.1	0.1
7/28/2022	105	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.15	0.1
7/29/2022	106	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.06	0.1
7/29/2022	107	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.11	0.1
7/29/2022	108	Standardization					PASS		
7/29/2022	109	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.03	0.1
7/29/2022	110	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.14	0.1
7/29/2022	111	Calibration	Red Film	Film	Red	Intact	Positive	1.2	0.1
7/29/2022	112	2nd Fl Hallway North	Wall	Plaster	Beige	Intact	Negative	0.02	0.01

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MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/29/2022	113	2nd Fl Hallway North	Wall	Plaster	Beige	Intact	Negative	<LOD	0.02
7/29/2022	114	2nd Fl Hallway North	Wall	Plaster	Beige	Intact	Negative	<LOD	0.03
7/29/2022	115	2nd Fl Hallway North	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
7/29/2022	**116**	**2nd Fl Hallway North**	**Baseboard**	**Wood**	**White**	**Fair**	**Positive**	**8.49**	**1.01**
7/29/2022	**117**	**2nd Fl Hallway North**	**Baluster**	**Wood**	**Beige**	**Fair**	**Positive**	**4.46**	**0.73**
7/29/2022	**118**	**2nd Fl Hallway North**	**Stringer**	**Wood**	**Beige**	**Fair**	**Positive**	**4.26**	**0.56**
7/29/2022	**119**	**2nd Fl Hallway North**	**Window Frame**	**Wood**	**Beige**	**Fair**	**Positive**	**6.22**	**1.58**
7/29/2022	**120**	**2nd Fl Hallway North**	**Window Sill**	**Wood**	**Beige**	**Fair**	**Positive**	**2.68**	**0.48**
7/29/2022	121	2nd Fl Hallway North	Wall	Plaster	Beige	Intact	Negative	<LOD	0.03
7/29/2022	**122**	**2nd Fl Hallway North**	**Door Frame**	**Wood**	**Beige**	**Fair**	**Positive**	**6.76**	**1**
7/29/2022	**123**	**2nd Fl Hallway North**	**Door**	**Wood**	**Beige**	**Fair**	**Positive**	**6.3**	**1.91**
7/29/2022	124	2nd Fl Hallway North	Door	Wood	White	Intact	Negative	<LOD	0.02
7/29/2022	125	2nd Fl Hallway North	Door Frame	Wood	White	Intact	Negative	<LOD	0.02
7/29/2022	126	217	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	127	217	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	128	217	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	129	217	Wall	Plaster	Beige	Intact	Negative	0.22	0.05
7/29/2022	130	217	Trim	Wood	Beige	Intact	Negative	0.07	0.04
7/29/2022	131	217	Trim	Wood	Beige	Intact	Negative	0.11	0.05
7/29/2022	132	217	Trim	Wood	Beige	Intact	Negative	0.03	0.01
7/29/2022	133	219	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	134	219	Wall	Plaster	Beige	Intact	Negative	0.08	0.02
7/29/2022	135	219	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	136	219	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	137	219	Trim	Drywall	Beige	Intact	Negative	0.11	0.06
7/29/2022	138	219	Trim	Drywall	Beige	Intact	Negative	0.15	0.07
7/29/2022	139	219	Trim	Drywall	Beige	Intact	Negative	0.02	0.01
7/29/2022	140	219	Trim	Drywall	Beige	Intact	Negative	0.07	0.04

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MONTROSE ENVIRONMENTAL

Table 2
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Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/29/2022	141	219	Trim	Drywall	Beige	Intact	Negative	0.04	0.02
7/29/2022	142	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.04	0.1
7/29/2022	143	215	Wall	Plaster	Beige	Intact	Negative	0.1	0.05
7/29/2022	144	215	Wall	Plaster	Beige	Intact	Negative	0.07	0.03
7/29/2022	145	215	Wall	Plaster	Beige	Intact	Negative	0.04	0.01
7/29/2022	146	215	Wall	Plaster	Beige	Intact	Negative	0.17	0.07
7/29/2022	147	215	Baseboard	Wood	Aqua	Intact	Negative	0.18	0.07
7/29/2022	148	215	Baseboard	Wood	Aqua	Intact	Negative	0.13	0.05
7/29/2022	149	215	Cabinet	Wood	Aqua	Intact	Negative	0.17	0.05
7/29/2022	150	215	Cabinet	Wood	Aqua	Intact	Negative	0.23	0.09
7/29/2022	151	215	Trim	Wood	Aqua	Intact	Negative	0.33	0.1
7/29/2022	152	215	Door Frame	Wood	Aqua	Intact	Negative	0.18	0.06
7/29/2022	153	215	Door Frame	Wood	Beige	Intact	Negative	0.36	0.1
7/29/2022	154	215	Door Jamb	Wood	Beige	Intact	Negative	0.39	0.1
7/29/2022	155	215	Door	Wood	Beige	Intact	Negative	0.39	0.1
7/29/2022	156	215	Door	Wood	Aqua	Intact	Negative	0.38	0.1
7/29/2022	157	215	Door	Wood	Light Blue	Intact	Negative	0.6	0.1
7/29/2022	158	Calibration	Red Film	Film	Red	Intact	Positive	1.54	0.1
7/29/2022	159	Calibration	Red Film	Film	White	Intact	Negative	0.72	0.1
7/29/2022	160	Calibration	Red Film	Film	White	Intact	Inconclusive	0.9	0.1
7/29/2022	161	Calibration	White Film	Film	White	Intact	Negative	<LOD	0.01
7/29/2022	162	Calibration	Red Film	Film	Red	Intact	Positive	1.15	0.1
7/29/2022	163	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.11	0.1
7/29/2022	164	215	Door	Wood	Light Blue	Intact	Negative	<LOD	0.03
7/29/2022	165	212	Wall	Plaster	Beige	Intact	Negative	<LOD	0.03
7/29/2022	166	212	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
7/29/2022	167	212	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
7/29/2022	168	212	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01

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Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/29/2022	169	212	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.05
7/29/2022	170	212	Window Sill	Wood	Beige	Intact	Negative	<LOD	0.06
7/29/2022	171	212	Window Sill	Wood	Beige	Intact	Negative	0.06	0.04
7/29/2022	172	212	Window Sill	Wood	Beige	Intact	Negative	<LOD	0.03
7/29/2022	173	2nd Fl Hall Main	Wall	Plaster	Beige	Intact	Negative	0.13	0.07
7/29/2022	174	2nd Fl Hall Main	Wall	Plaster	Beige	Intact	Negative	0.5	0.1
7/29/2022	175	2nd Fl Hall Main	Wall	Plaster	Beige	Intact	Negative	0.14	0.07
7/29/2022	176	2nd Fl Hall Main	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	177	2nd Fl Hall Main	Wall	Brick	Beige	Intact	Negative	0.28	0.06
7/29/2022	178	207	Wall	Plaster	Beige	Intact	Negative	<LOD	0.04
7/29/2022	179	207	Wall	Plaster	Beige	Intact	Negative	<LOD	0.02
7/29/2022	180	207	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	181	207	Wall	Plaster	Beige	Intact	Negative	0.03	0.01
7/29/2022	182	207	Wall	Plaster	Beige	Intact	Negative	0.07	0.04
7/29/2022	183	207	Chalkboard Frame	Wood	Beige	Intact	Negative	<LOD	0.02
7/29/2022	184	207	Window Frame	Wood	Beige	Intact	Negative	<LOD	0.03
7/29/2022	185	207	Window Sill	Wood	Beige	Intact	Negative	0.07	0.04
7/29/2022	186	207	Window Sill	Wood	Beige	Intact	Negative	<LOD	0.04
7/29/2022	187	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.1	0.1
7/29/2022	188	Science Hall Ramp	Wall	Brick	Beige	Intact	Negative	0.44	0.18
7/29/2022	189	Science Hall Ramp	Wall	Brick	Beige	Intact	Negative	0.13	0.06
7/29/2022	190	Science Hall Ramp	Wall	Brick	Beige	Intact	Negative	<LOD	0.02
7/29/2022	191	Science Hall Ramp	Wall	Drywall	Beige	Intact	Negative	0.04	0.01
7/29/2022	192	Science Hall Ramp	Wall	Concrete	Beige	Intact	Negative	0.07	0.02
7/29/2022	193	Science Hall Ramp	Wall	Concrete	Beige	Intact	Negative	0.06	0.03
7/29/2022	194	Science Hall Ramp	Wall	Concrete	Beige	Intact	Negative	0.21	0.05
7/29/2022	195	Science Hall Ramp	Wall	Drywall	Beige	Intact	Negative	0.05	0.01
7/29/2022	196	Science Hall Ramp	Wall	Brick	Beige	Intact	Negative	0.06	0.04

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Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/29/2022	197	201	Wall	Concrete	Beige	Intact	Negative	0.06	0.02
7/29/2022	198	201	Wall	Concrete	Beige	Intact	Negative	0.08	0.01
7/29/2022	199	201	Wall	Concrete	Beige	Intact	Negative	0.09	0.01
7/29/2022	200	201	Wall	Concrete	Beige	Intact	Negative	0.05	0.01
7/29/2022	201	Calibration	Red Film	Film	Red	Intact	Positive	1.24	0.1
7/29/2022	202	200	Wall	Drywall	Beige	Intact	Negative	0.08	0.01
7/29/2022	203	200	Wall	Drywall	Beige	Intact	Negative	0.07	0.02
7/29/2022	204	200	Wall	Drywall	Beige	Intact	Negative	0.04	0.01
7/29/2022	205	200	Wall	Concrete	Beige	Intact	Negative	0.07	0.01
7/29/2022	206	200	Window Sill	Wood	Beige	Intact	Negative	0.41	0.1
7/29/2022	207	200	Window Sill	Wood	Beige	Intact	Negative	0.31	0.1
7/29/2022	208	200	Window Sill	Wood	Beige	Intact	Negative	0.37	0.1
7/29/2022	**209**	**202**	**Window Frame**	**Wood**	**Beige**	**Fair**	**Positive**	**15.02**	**1.27**
7/29/2022	210	202	Window Box Cover	Wood	Beige	Intact	Negative	0.14	0.01
7/29/2022	211	Science Hall W Restroom	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	212	Science Hall W Restroom	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
7/29/2022	213	Science Hall W Restroom	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	214	Science Hall W Restroom	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	215	Science Hall W Restroom	Window Sill	Wood	Beige	Intact	Negative	<LOD	0.01
7/29/2022	216	Science Hall Stairwell	Wainscoting	Concrete	Beige	Intact	Negative	<LOD	0.01
7/29/2022	217	Science Hall Stairwell	Wainscoting	Concrete	Beige	Intact	Negative	<LOD	0.01
7/29/2022	218	Science Hall Stairwell	Wainscoting	Concrete	Beige	Intact	Negative	<LOD	0.01
7/29/2022	219	Science Hall Stairwell	Wainscoting	Concrete	Beige	Intact	Negative	<LOD	0.01
7/29/2022	220	Science Hall Stairwell	Railing	Metal	Blue	Intact	Negative	<LOD	0.01
7/29/2022	221	Science Hall Stairwell	Stringer	Metal	Blue	Intact	Negative	<LOD	0.01
7/29/2022	222	Science Hall Stairwell	Riser	Metal	Blue	Intact	Negative	<LOD	0.01
7/29/2022	223	Calibration	Red Film	Film	Red	Intact	Inconclusive	0.96	0.1
7/29/2022	224	Calibration	Red Film	Film	Red	Intact	Positive	1.18	0.1

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/29/2022	225	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.03	0.1
7/29/2022	226	Standardization					PASS		
7/29/2022	227	Calibration	Red Film	Film	Red	Intact	Inconclusive	0.93	0.1
7/29/2022	228	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.05	0.1
7/29/2022	229	Calibration	Red Film	Film	Red	Intact	Inconclusive	0.94	0.1
7/29/2022	230	Exterior	Library Window	Wood	White	Intact	Negative	<LOD	0.01
7/29/2022	231	Exterior	Library Window	Wood	White	Intact	Negative	<LOD	0.01
7/29/2022	232	Exterior	Door 03 Frame	Wood	White	Fair	Negative	0.46	0.13
7/29/2022	**233**	**Exterior**	**Door 03 Frame**	**Wood**	**White**	**Fair**	**Positive**	**2.05**	**0.33**
7/29/2022	**234**	**Exterior**	**Door 02 Frame**	**Wood**	**White**	**Intact**	**Positive**	**2.78**	**0.55**
7/29/2022	235	Exterior	Door 01 Frame	Wood	White	Intact	Negative	0.02	0.01
7/29/2022	236	Exterior	Door 01 Frame	Wood	White	Intact	Negative	0.22	0.1
7/29/2022	237	Exterior	Door 01 Frame	Wood	White	Intact	Negative	0.06	0.04
7/29/2022	238	Exterior	Door 01 Frame	Wood	White	Intact	Negative	0.05	0.03
7/29/2022	239	Exterior	Door 01 Frame	Wood	White	Intact	Negative	0.35	0.1
7/29/2022	240	Exterior	Door 01 Frame	Wood	White	Intact	Inconclusive	0.87	0.11
7/29/2022	241	Exterior	Door 01 Frame	Wood	White	Intact	Inconclusive	1.13	0.14
7/29/2022	242	Exterior	Door 01 Frame	Wood	White	Intact	Negative	0.22	0.06
7/29/2022	243	Exterior	Door 01 Frame	Wood	White	Intact	Negative	<LOD	0.09
7/29/2022	244	Exterior	Door 01 Frame	Wood	White	Intact	Inconclusive	0.86	0.12
7/29/2022	245	Exterior	Door 08	Wood	White	Fair	Inconclusive	0.97	0.15
7/29/2022	**246**	**Exterior**	**Door 08**	**Wood**	**White**	**Intact**	**Positive**	**2.04**	**0.34**
7/29/2022	247	Exterior	Door 102	Wood	White	Intact	Negative	0.62	0.21
7/29/2022	248	Exterior	Door 102	Wood	White	Intact	Negative	0.59	0.1
7/29/2022	249	Exterior	Door 102	Wood	White	Fair	Negative	0.85	0.1
7/29/2022	**250**	**Exterior**	**Door 102**	**Wood**	**White**	**Intact**	**Positive**	**2.26**	**0.35**
7/29/2022	251	116	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	252	116	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
7/29/2022	253	116	Wall	Drywall	Beige	Intact	Negative	<LOD	0.02
7/29/2022	254	116	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	255	116 Hall	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	256	116 Hall	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	257	116 Hall	Wall	Brick	Beige	Intact	Negative	<LOD	0.02
7/29/2022	258	116 Hall	Wall	Drywall	Beige	Intact	Negative	0.04	0.02
7/29/2022	259	116 Hall	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
7/29/2022	260	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.11	0.1
7/29/2022	261	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.04	0.1
7/29/2022	262	Calibration	Red Film	Film	Red	Intact	Positive	1.15	0.1
8/2/2022	280	Standardization					Pass		
8/2/2022	281	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.07	0.1
8/2/2022	282	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.02	0.1
8/2/2022	283	Calibration	Red Film	Film	Red	Intact	Inconclusive	1.08	0.1
8/2/2022	284	114	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	285	114	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	286	114	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	**287**	**114**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**5.29**	**1.27**
8/2/2022	**288**	**114**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**6.08**	**0.9**
8/2/2022	289	114	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	290	114	Wall	Drywall	Beige	Intact	Negative		
8/2/2022	291	Storage Across 114	Wall	Concrete	Beige	Intact	Negative	0.02	0.01
8/2/2022	292	Storage Across 114	Wall	Concrete	Beige	Intact	Negative	<LOD	0.34
8/2/2022	293	Storage Across 114	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
8/2/2022	294	Storage Across 114	Wall	Concrete	Beige	Intact	Negative	0.02	0.01
8/2/2022	295	Hall	Floor	Concrete	Gray	Intact	Negative	<LOD	0.04
8/2/2022	296	Hall	Wall	Plaster	Beige	Intact	Negative	<LOD	0.04
8/2/2022	297	Hall	Wall	Plaster	Beige	Intact	Negative	<LOD	0.1

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/2/2022	298	Hall	Wall	Drywall	Beige	Intact	Negative	<LOD	0.11
8/2/2022	299	Hall	Wall	Drywall	Beige	Intact	Negative	<LOD	0.45
8/2/2022	300	Hall	Wall	Drywall	Beige	Intact	Inconclusive	2.32	1.14
8/2/2022	301	Hall	Wall	Drywall	Beige	Intact	Negative	0.24	0.14
8/2/2022	302	Hall	Wall	Plaster	Beige	Intact	Negative	<LOD	0.24
8/2/2022	303	Hall	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	304	112	Door Frame	Drywall	Blue	Intact	Negative	<LOD	0.01
8/2/2022	305	112	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	306	112	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	307	112	Wall	Plaster	Beige	Intact	Negative	<LOD	0.1
8/2/2022	308	112	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	309	112	Wall	Drywall	Beige	Intact	Negative	<LOD	0.45
8/2/2022	310	112	Wall	Plaster	Beige	Intact	Negative	<LOD	0.11
8/2/2022	311	112	Wall	Plaster	Beige	Intact	Negative	<LOD	0.1
8/2/2022	312	112	Wall	Drywall	Beige	Intact	Negative	0.03	0.01
8/2/2022	313	112	Wall	Drywall	White	Intact	Negative	<LOD	0.01
8/2/2022	314	112	Wall	Drywall	Beige	Intact	Negative	0.04	0.01
8/2/2022	315	112	Archway	Plaster	Beige	Intact	Inconclusive	<LOD	4.21
8/2/2022	**316**	**By 112**	**Archway**	**Plaster**	**Beige**	**Fair**	**Positive**	**4.86**	**1.94**
8/2/2022	**317**	**By 112**	**Archway**	**Plaster**	**Beige**	**Fair**	**Positive**	**5.47**	**1.9**
8/2/2022	318	By 112	Archway	Plaster	Beige	Intact	Inconclusive	<LOD	0.79
8/2/2022	319	By 112	Archway	Plaster	Beige	Intact	Inconclusive	<LOD	1.74
8/2/2022	**320**	**By 112**	**Archway**	**Wood**	**Beige**	**Fair**	**Positive**	**4.27**	**1.62**
8/2/2022	**321**	**By 112**	**Archway**	**Wood**	**Beige**	**Fair**	**Positive**	**2.69**	**0.8**
8/2/2022	322	By 112	Archway	Wood	Beige	Intact	Inconclusive	<LOD	2.55
8/2/2022	**323**	**By 112**	**Archway**	**Wood**	**Beige**	**Fair**	**Positive**	**2.26**	**0.6**
8/2/2022	**324**	**By 112**	**Baseboard**	**Wood**	**White**	**Fair**	**Positive**	**4.92**	**1.71**
8/2/2022	325	By 112	Baseboard	Wood	White	Intact	Inconclusive	<LOD	7.24

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/2/2022	**326**	**By 112**	**Baseboard**	**Wood**	**White**	**Fair**	**Positive**	**5.65**	**2.23**
8/2/2022	**327**	**By 112**	**Baseboard**	**Wood**	**White**	**Fair**	**Positive**	**3.67**	**1.4**
8/2/2022	328	Stairs By 112	Stringer	Metal	Beige	Intact	Inconclusive	<LOD	3.48
8/2/2022	**329**	**Stairs By 112**	**Stringer**	**Metal**	**Beige**	**Fair**	**Positive**	**5.56**	**1.85**
8/2/2022	330	Stairs By 112	Stringer	Metal	Beige	Intact	Inconclusive	<LOD	4.82
8/2/2022	**331**	**Stairs By 112**	**Stringer**	**Metal**	**Beige**	**Fair**	**Positive**	**4.07**	**1.25**
8/2/2022	332	Stairs By 112	Riser	Concrete	Black	Intact	Inconclusive	0.95	0.17
8/2/2022	333	Stairs By 112	Riser	Concrete	Black	Intact	Negative	<LOD	0.44
8/2/2022	**334**	**Stairs By 112**	**Riser**	**Concrete**	**Black**	**Fair**	**Positive**	**1.58**	**0.3**
8/2/2022	335	Stairs By 112	Riser	Concrete	Black	Intact	Negative	0.37	0.21
8/2/2022	**336**	**Stairs By 112**	**Door Frame**	**Concrete**	**White**	**Fair**	**Positive**	**3.76**	**1.2**
8/2/2022	337	Stairs By 112	Door Frame	Concrete	White	Intact	Inconclusive	2.36	1.34
8/2/2022	**338**	**Stairs By 112**	**Door Frame**	**Wood**	**White**	**Fair**	**Positive**	**7**	**2.63**
8/2/2022	339	Stairs By 112	Door Frame	Metal	White	Intact	Negative	0.02	0.01
8/2/2022	340	Stairs By 112	Window Sill	Wood	Beige	Intact	Negative	<LOD	0.52
8/2/2022	341	Stairs By 112	Window Sill	Wood	Beige	Intact	Inconclusive	1.72	0.66
8/2/2022	342	Stairs By 112	Window Sill	Wood	Beige	Intact	Negative	<LOD	0.37
8/2/2022	343	Stairs By 109	Baseboard	Concrete	Black	Intact	Negative	<LOD	0.15
8/2/2022	344	109	Door Frame	Metal	Blue	Intact	Negative	0.03	0.01
8/2/2022	345	109	Closet Jamb	Metal	Blue	Intact	Negative	<LOD	0.04
8/2/2022	346	109	Door	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	347	109	Door Frame	Metal	Blue	Intact	Negative	0.03	0.01
8/2/2022	348	109	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.04
8/2/2022	349	109	Door Header	Metal	Blue	Intact	Negative	0.03	0.01
8/2/2022	350	109	Wall	Plaster	Beige	Intact	Negative	0.05	0.01
8/2/2022	351	109	Wall	Plaster	Beige	Intact	Negative	<LOD	0.45
8/2/2022	352	109	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
8/2/2022	353	109	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01

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8/2/2022	354	109	Wall	Plaster	Beige	Intact	Negative	<LOD	0.08
8/2/2022	355	109	Wall	Wood	Beige	Intact	Negative	<LOD	0.04
8/2/2022	356	109	Wall	Plaster	Blue	Intact	Negative	<LOD	0.1
8/2/2022	357	Main Office 110-3	Door Frame	Plaster	Red	Intact	Negative	<LOD	0.01
8/2/2022	358	Main Office 110-3	Door Header	Plaster	Red	Intact	Negative	<LOD	0.01
8/2/2022	359	Main Office 110-3	Door Frame	Metal	Red	Intact	Negative	<LOD	0.03
8/2/2022	360	Main Office 110-3	Door Jamb	Metal	Red	Intact	Negative	<LOD	0.01
8/2/2022	361	Main Office 110-3	Wall	Drywall	Beige	Intact	Negative	<LOD	0.03
8/2/2022	362	Main Office 110-3	Wall	Drywall	Beige	Intact	Negative	0.03	0.01
8/2/2022	363	Main Office 110-3	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	364	Main Office 110-3	Wall	Drywall	Beige	Intact	Negative	0.03	0.01
8/2/2022	365	Main Office 110-3	Wall	Drywall	Beige	Intact	Negative	<LOD	0.03
8/2/2022	366	Main Office 110-3	Window Sill	Wood	Red	Intact	Positive	1.57	0.38
8/2/2022	**367**	**Main Office 110-3**	**Window Sill**	**Wood**	**Red**	**Intact**	**Positive**	**1.83**	**0.49**
8/2/2022	368	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	1.14	0.13
8/2/2022	369	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	1.05	0.56
8/2/2022	370	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	2.44
8/2/2022	371	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	0.9
8/2/2022	372	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	1.27
8/2/2022	373	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	0.69
8/2/2022	374	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	1.13
8/2/2022	**375**	**Main Office 110-3**	**Window Sill**	**Wood**	**Red**	**Intact**	**Positive**	**2.13**	**0.52**
8/2/2022	376	Main Office 110-3	Window Sill	Wood	Red	Intact	Negative	<LOD	0.58
8/2/2022	377	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	1.22
8/2/2022	378	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	1.47	0.58
8/2/2022	379	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	0.98	0.6
8/2/2022	380	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	0.74
8/2/2022	381	Main Office 110-3	Window Sill	Wood	Red	Intact	Inconclusive	<LOD	0.93

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MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/2/2022	382	Main Office 110-3	Window Sill	Wood	Red	Intact	Negative	<LOD	0.64
8/2/2022	383	107	Wainscoting	Plaster	Beige	Intact	Negative	<LOD	0.08
8/2/2022	384	107	Wainscoting	Plaster	Beige	Intact	Negative	<LOD	0.15
8/2/2022	385	107	Wainscoting	Plaster	Beige	Intact	Negative	<LOD	0.04
8/2/2022	386	107	Wainscoting	Plaster	Beige	Intact	Negative	<LOD	0.1
8/2/2022	387	Br By 110	Wall	Plaster	Beige	Intact	Negative	0.05	0.01
8/2/2022	388	Br By 110	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
8/2/2022	389	Br By 110	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
8/2/2022	390	Br By 110	Wall	Plaster	Beige	Intact	Negative	<LOD	0.76
8/2/2022	391	Br By 110	Baseboard	Wood	Red	Intact	Negative	<LOD	0.04
8/2/2022	392	Hall By 110	Column	Wood	Beige	Intact	Inconclusive	<LOD	0.65
8/2/2022	393	Hall By 110	Column	Wood	Beige	Intact	Negative	<LOD	0.61
8/2/2022	394	Hall By 110	Column	Wood	Beige	Intact	Inconclusive	<LOD	4.19
8/2/2022	395	Hall By 110	Column	Wood	Beige	Intact	Inconclusive	<LOD	2.43
8/2/2022	396	Hall By 110	Column	Wood	Beige	Intact	Inconclusive	<LOD	1.69
8/2/2022	397	Hall By 110	Column	Wood	Beige	Intact	Inconclusive	<LOD	1.1
8/2/2022	398	Hall By 110	Column	Wood	Beige	Intact	Negative	<LOD	0.37
8/2/2022	399	Mech Rm	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	400	Mech Rm	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	401	Mech Rm	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
8/2/2022	402	Mech Rm	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	403	Elec Rm	Wall	Plaster	Beige	Intact	Negative	<LOD	0.2
8/2/2022	404	Elec Rm	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	405	Elec Rm	Wall	Plaster	Beige	Intact	Negative	<LOD	0.05
8/2/2022	406	Elec Rm	Wall	Plaster	Beige	Intact	Negative	<LOD	0.11
8/2/2022	407	Elevator Area	Door Frame	Metal	Blue	Intact	Negative	0.02	0.01
8/2/2022	408	Elevator Area	Door Jamb	Metal	Blue	Intact	Negative	0.02	0.01
8/2/2022	409	Elevator Area	Door	Wood	Blue	Intact	Negative	0.02	0.01

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8/2/2022	410	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	<LOD	0.78
8/2/2022	**411**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**4.69**	**1.93**
8/2/2022	412	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	<LOD	2.93
8/2/2022	**413**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**3.55**	**1.21**
8/2/2022	**414**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**3.97**	**1.54**
8/2/2022	415	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	3.21	1.95
8/2/2022	**416**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**3.56**	**1.33**
8/2/2022	417	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	<LOD	1.28
8/2/2022	418	Main Entrance	Trim	Wood	Beige	Intact	Negative	<LOD	0.45
8/2/2022	**419**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**3.98**	**1.62**
8/2/2022	**420**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**3.7**	**1.33**
8/2/2022	**421**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**3.94**	**1.57**
8/2/2022	422	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	<LOD	0.84
8/2/2022	423	Main Entrance	Trim	Wood	Beige	Intact	Negative	<LOD	0.58
8/2/2022	**424**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**5.89**	**2.44**
8/2/2022	**425**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**2.29**	**0.42**
8/2/2022	426	Main Entrance	Trim	Wood	Beige	Intact	Negative	<LOD	0.26
8/2/2022	427	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	<LOD	1.78
8/2/2022	428	Main Entrance	Trim	Wood	Beige	Intact	Inconclusive	<LOD	3.53
8/2/2022	**429**	**Main Entrance**	**Trim**	**Wood**	**Beige**	**Fair**	**Positive**	**7.35**	**3.09**
8/2/2022	430	105	Wall	Drywall	Beige	Intact	Inconclusive	<LOD	0.8
8/2/2022	431	105	Wall	Drywall	Beige	Intact	Negative	0.07	0.01
8/2/2022	432	105	Wall	Plaster	Beige	Intact	Negative	0.07	0.01
8/2/2022	433	105	Wall	Plaster	Beige	Intact	Negative	<LOD	0.01
8/2/2022	434	105	Wall	Drywall	Beige	Intact	Negative	0.09	0.01
8/2/2022	435	108-1	Wall	Drywall	Beige	Intact	Negative	0.11	0.01
8/2/2022	436	108-1	Wall	Drywall	Beige	Intact	Negative	<LOD	0.58
8/2/2022	437	108-1	Wall	Plaster	Beige	Intact	Negative	0.14	0.01

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202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/2/2022	438	108-1	Wall	Drywall	Beige	Intact	Negative	0.07	0.01
8/2/2022	439	108-1	Door Frame	Drywall	Green	Intact	Negative	0.02	0.01
8/2/2022	440	108-1	Door Frame	Metal	Green	Intact	Negative	0.07	0.01
8/2/2022	441	108-1	Door Jamb	Metal	Green	Intact	Negative	<LOD	0.01
8/2/2022	442	108-2	Wall	Drywall	Blue	Intact	Negative	<LOD	0.01
8/2/2022	443	108-2	Wall	Drywall	Blue	Intact	Negative	<LOD	0.01
8/2/2022	444	108-2	Wall	Drywall	Blue	Intact	Negative	<LOD	0.25
8/2/2022	445	108-2	Wall	Drywall	Blue	Intact	Negative	<LOD	0.01
8/2/2022	446	108	Trim	Wood	White	Intact	Negative	<LOD	0.01
8/2/2022	447	Nurse 106	Door Frame	Metal	Green	Intact	Negative	<LOD	0.01
8/2/2022	448	Nurse 106	Door Jamb	Metal	Green	Intact	Negative	<LOD	0.23
8/2/2022	449	Nurse 106	Wall	Drywall	Beige	Intact	Negative	<LOD	0.48
8/2/2022	450	Nurse 106	Wall	Drywall	Beige	Intact	Negative	0.02	0.01
8/2/2022	451	Nurse 106	Wall	Drywall	Beige	Intact	Negative	0.03	0.01
8/2/2022	452	Nurse 106	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	453	Storage By 106	Wall	Plaster	Beige	Intact	Negative	0.03	0.01
8/2/2022	454	Storage By 106	Wall	Plaster	Beige	Intact	Negative	<LOD	0.04
8/2/2022	455	Storage By 106	Wall	Drywall	Beige	Intact	Negative	0.05	0.01
8/2/2022	456	Storage By 106	Wall	Plaster	Beige	Intact	Negative	<LOD	0.41
8/2/2022	457	Storage By 106	Door Frame	Plaster	Beige	Intact	Negative		
8/2/2022	458	Storage By 106	Door Frame	Metal	Blue	Intact	Negative	0.02	0.01
8/2/2022	459	Storage By 106	Door Jamb	Metal	Blue	Intact	Negative	0.02	0.01
8/2/2022	460	Cafe	Wall	Brick	Beige	Intact	Negative	<LOD	0.08
8/2/2022	461	Cafe	Wall	Brick	Beige	Intact	Negative	<LOD	0.38
8/2/2022	462	Cafe	Wall	Brick	Beige	Intact	Negative	<LOD	0.11
8/2/2022	463	Cafe	Wall	Brick	Beige	Intact	Negative	0.02	0.01
8/2/2022	464	Cafe	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	465	Kitchen 102	Door Frame	Metal	Blue	Intact	Negative	0.04	0.01

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/2/2022	466	Kitchen 102	Door Jamb	Metal	Beige	Intact	Negative	<LOD	0.4
8/2/2022	467	Kitchen 102	Door Jamb	Metal	Beige	Intact	Negative	<LOD	0.01
8/2/2022	468	Kitchen 102	Wall	Drywall	Beige	Intact	Negative	0.06	0.01
8/2/2022	469	Kitchen 102	Wall	Brick	Beige	Intact	Negative	0.12	0.01
8/2/2022	470	Kitchen 102	Wall	Brick	Beige	Intact	Negative	<LOD	0.11
8/2/2022	471	Kitchen 102	Wall	Concrete	Beige	Intact	Negative	0.15	0.01
8/2/2022	472	Kitchen 102	Wall	Concrete	Beige	Intact	Negative	0.03	0.01
8/2/2022	473	Kitchen 102	Wall	Brick	Beige	Intact	Negative	<LOD	0.16
8/2/2022	474	103	Door Frame	Brick	Blue	Intact	Negative	0.09	0.01
8/2/2022	475	103	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.3
8/2/2022	476	103	Door Jamb	Metal	Blue	Intact	Negative	0.09	0.01
8/2/2022	477	103	Wall	Concrete	Beige	Intact	Negative	0.14	0.01
8/2/2022	478	103	Wall	Concrete	Beige	Intact	Negative	0.11	0.05
8/2/2022	479	103	Wall	Concrete	Beige	Intact	Negative	0.19	0.01
8/2/2022	480	103	Wall	Concrete	Beige	Intact	Negative	0.36	0.2
8/2/2022	481	103	Wall	Concrete	Beige	Intact	Negative	0.06	0.02
8/2/2022	482	103	Tread	Metal	Blue	Intact	Negative	0.03	0.01
8/2/2022	483	103 Hallway	Floor	Concrete	Gray	Intact	Negative	0.14	0.03
8/2/2022	484	103 Hallway	Floor	Concrete	Gray	Intact	Negative	0.29	0.06
8/2/2022	485	103 Hallway	Wall	Plaster	Beige	Intact	Negative	0.56	0.2
8/2/2022	486	103 Hallway	Wall	Plaster	Beige	Intact	Negative	<LOD	0.33
8/2/2022	487	103 Hallway	Wall	Plaster	Beige	Intact	Negative	<LOD	0.39
8/2/2022	488	103 Hallway	Wall	Plaster	Beige	Intact	Negative	0.23	0.01
8/2/2022	489	103 Hallway	Wall	Drywall	Beige	Intact	Negative	0.43	0.1
8/2/2022	490	103 Hallway	Wall	Drywall	Beige	Intact	Negative	0.45	0.1
8/2/2022	491	103 Hallway	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	492	103 Hallway	Wall	Brick	Beige	Intact	Negative	<LOD	0.17
8/2/2022	493	Music Rm 100	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.01

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/2/2022	494	Music Rm 100	Door Header	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	495	Music Rm 100	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.01
8/2/2022	496	Music Rm 100	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/2/2022	497	Music Rm 100	Wall	Concrete	Beige	Intact	Negative	0.02	0.01
8/2/2022	498	Music Rm 100	Wall	Concrete	Beige	Intact	Negative	<LOD	0.55
8/2/2022	499	Music Rm 100	Wall	Concrete	Beige	Intact	Inconclusive	<LOD	0.65
8/2/2022	**500**	**Music Rm 100**	**Wall**	**Brick**	**Beige**	**Intact**	**Positive**	**4.45**	**1.47**
8/3/2022	**501**	**Music Rm 100**	**Wall**	**Brick**	**Beige**	**Intact**	**Positive**	**3.47**	**1.22**
8/3/2022	**502**	**Music Rm 100**	**Wall**	**Brick**	**Beige**	**Intact**	**Positive**	**1.97**	**0.26**
8/3/2022	503	Music Rm 100	Wall	Brick	Beige	Intact	Inconclusive	<LOD	0.64
8/3/2022	504	Music Rm 100	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1.12
8/3/2022	505	Music Rm 100	Wall	Brick	Beige	Intact	Inconclusive	<LOD	3.74
8/3/2022	**506**	**Music Rm 100**	**Wall**	**Brick**	**Beige**	**Intact**	**Positive**	**2.6**	**0.99**
8/3/2022	507	Music Rm 100	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1.65
8/3/2022	508	Music Rm 100	Wall	Brick	Beige	Intact	Negative	<LOD	0.35
8/3/2022	509	Music Rm 100	Wall	Drywall	Beige	Intact	Negative	<LOD	0.01
8/3/2022	510	Music Rm 100	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
8/3/2022	511	Music Rm 100-A	Door Frame	Concrete	Red	Intact	Negative	<LOD	0.25
8/3/2022	512	Music Rm 100-A	Door Frame	Concrete	Red	Intact	Negative	<LOD	0.32
8/3/2022	513	Music Rm 100-A	Door Jamb	Concrete	Red	Intact	Negative	<LOD	0.01
8/3/2022	514	Music Rm 100-A	Door Header	Concrete	Red	Intact	Negative	<LOD	0.01
8/3/2022	515	Hall	Railing	Metal	Blue	Intact	Negative	<LOD	0.01
8/3/2022	516	Hall	Railing	Metal	Blue	Intact	Negative	0.02	0.01
8/3/2022	517	Calibration			Red	Intact	Inconclusive	1.02	0.1
8/3/2022	518	Calibration			Red	Intact	Inconclusive	1.01	0.1
8/3/2022	519	Calibration			Red	Intact	Inconclusive	0.96	0.1
8/3/2022	520					Intact			
8/3/2022	521	Calibration			Red	Intact	Inconclusive	1.08	0.1

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8/3/2022	522	Calibration			Red	Intact	Inconclusive	1.01	0.1
8/3/2022	523	Calibration			Red	Intact	Inconclusive	0.98	0.1
8/3/2022	524	Mech Rm Platform	Platform	Concrete	Beige	Intact	Negative	<LOD	0.01
8/3/2022	**525**	**Basement By Front St**	**Door Frame**	**Concrete**	**Beige**	**Intact**	**Positive**	**1.54**	**0.28**
8/3/2022	**526**	**Basement By Front St**	**Door Frame**	**Concrete**	**Beige**	**Intact**	**Positive**	**2.21**	**0.59**
8/3/2022	527	Basement By Front St	Door Frame	Concrete	Beige	Intact	Inconclusive	<LOD	0.79
8/3/2022	528	Basement By Front St	Door Frame	Concrete	Beige	Intact	Inconclusive	<LOD	1.23
8/3/2022	529	Basement By Front St	Door Frame	Concrete	Beige	Intact	Inconclusive	<LOD	0.68
8/3/2022	530	Basement By Front St	Door Frame	Concrete	Beige	Intact	Negative	<LOD	0.64
8/3/2022	531	Basement By Front St	Door Frame	Metal	Beige	Intact	Inconclusive	1.24	0.24
8/3/2022	**532**	**Basement By Front St**	**Door Frame**	**Metal**	**Beige**	**Fair**	**Positive**	**1.48**	**0.31**
8/3/2022	**533**	**Basement By Front St**	**Door Frame**	**Metal**	**Beige**	**Fair**	**Positive**	**1.68**	**0.4**
8/3/2022	**534**	**Basement By Front St**	**Door Jamb**	**Metal**	**Beige**	**Fair**	**Positive**	**2.06**	**0.47**
8/3/2022	**535**	**Basement By Front St**	**Door Jamb**	**Metal**	**Beige**	**Fair**	**Positive**	**2.47**	**0.45**
8/3/2022	**536**	**Basement By Front St**	**Door**	**Wood**	**Beige**	**Fair**	**Positive**	**2.36**	**0.55**
8/3/2022	**537**	**Basement By Front St**	**Door**	**Wood**	**Beige**	**Fair**	**Positive**	**2.87**	**1.23**
8/3/2022	**538**	**Basement By Front St**	**Door**	**Wood**	**Beige**	**Fair**	**Positive**	**2.19**	**0.62**
8/3/2022	539	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.12
8/3/2022	540	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.14
8/3/2022	541	Basement By Front St	Wall	Brick	Beige	Intact	Negative	<LOD	0.07
8/3/2022	542	Basement By Front St	Door Frame	Brick	Red	Intact	Negative	0.49	0.18
8/3/2022	543	Basement By Front St	Door Frame	Brick	Red	Intact	Negative	0.45	0.24
8/3/2022	544	Basement By Front St	Door Frame	Wood	Red	Intact	Inconclusive	0.8	0.24
8/3/2022	545	Basement By Front St	Door Frame	Wood	Red	Intact	Inconclusive	0.93	0.18
8/3/2022	546	Basement By Front St	Door Frame	Wood	Red	Intact	Negative	0.45	0.26
8/3/2022	547	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	0.67	0.43
8/3/2022	548	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	1.06	0.2
8/3/2022	549	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	0.88	0.53

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	550	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	<LOD	1.54
8/3/2022	551	Basement By Front St	Door Frame	Metal	Red	Intact	Negative	<LOD	0.47
8/3/2022	552	Basement By Front St	Door	Wood	Red	Intact	Inconclusive	0.58	0.35
8/3/2022	553	Basement By Front St	Door	Wood	Red	Intact	Positive	1.34	0.22
8/3/2022	**554**	**Basement By Front St**	**Door**	**Wood**	**Red**	**Fair**	**Positive**	**1.24**	**0.11**
8/3/2022	**555**	**Basement By Front St**	**Door**	**Wood**	**Red**	**Fair**	**Positive**	**1.22**	**0.1**
8/3/2022	556	Basement By Front St	Door	Metal	Red	Intact	Inconclusive	1.32	0.22
8/3/2022	**557**	**Basement By Front St**	**Door**	**Metal**	**Red**	**Fair**	**Positive**	**1.36**	**0.21**
8/3/2022	558	Basement By Front St	Door	Wood	White	Poor	Inconclusive	0.95	0.24
8/3/2022	559	Basement By Front St	Door	Wood	White	Poor	Inconclusive	0.89	0.59
8/3/2022	560	Basement By Front St	Door	Wood	White	Poor	Inconclusive	<LOD	1.08
8/3/2022	561	Basement By Front St	Door	Wood	White	Poor	Negative	<LOD	0.59
8/3/2022	562	Basement By Front St	Door	Wood	White	Poor	Negative	<LOD	0.61
8/3/2022	563	Basement By Front St	Door	Wood	White	Poor	Inconclusive	<LOD	0.81
8/3/2022	564	Basement By Front St	Door	Wood	White	Poor	Inconclusive	<LOD	0.75
8/3/2022	565	Basement By Front St	Door	Wood	White	Poor	Inconclusive	<LOD	0.93
8/3/2022	566	Basement By Front St	Door	Wood	White	Poor	Inconclusive	<LOD	0.88
8/3/2022	567	Basement By Front St	Door	Wood	White	Poor	Negative	<LOD	0.54
8/3/2022	568	Basement By Front St	Door Frame	Wood	White	Intact	Inconclusive	<LOD	0.92
8/3/2022	569	Basement By Front St	Door Frame	Wood	White	Intact	Negative	<LOD	0.64
8/3/2022	570	Basement By Front St	Door Jamb	Wood	White	Intact	Inconclusive	<LOD	0.99
8/3/2022	571	Basement By Front St	Door Jamb	Wood	White	Intact	Negative	<LOD	0.46
8/3/2022	572	Basement By Front St	Wall	Brick	White	Intact	Negative	<LOD	0.1
8/3/2022	573	Basement By Front St	Wall	Brick	White	Intact	Negative	<LOD	0.1
8/3/2022	574	Basement By Front St	Wall	Concrete	White	Intact	Negative	<LOD	0.31
8/3/2022	575	Basement By Front St	Wall	Concrete	White	Intact	Negative	<LOD	0.5
8/3/2022	576	Basement By Front St	Wall	Concrete	White	Intact	Negative	<LOD	0.1
8/3/2022	577	Basement By Front St	Door	Wood	Green	Intact	Negative	<LOD	0.06

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Table 2
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Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	578	Basement By Front St	Door	Wood	Tan	Intact	Negative	<LOD	0.1
8/3/2022	579	Basement By Front St	Door	Wood	Tan	Intact	Inconclusive	0.92	0.25
8/3/2022	580	Basement By Front St	Door	Wood	Green	Intact	Negative	<LOD	0.49
8/3/2022	581	Basement By Front St	Door	Concrete	Tan	Intact	Negative	<LOD	0.08
8/3/2022	582	Basement By Front St	Door	Concrete	Tan	Intact	Negative	<LOD	0.13
8/3/2022	583	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.1
8/3/2022	584	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.08
8/3/2022	585	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.11
8/3/2022	586	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.06
8/3/2022	587	Basement By Front St	Wall	Brick	Tan	Intact	Negative	<LOD	0.04
8/3/2022	588	Basement By Front St	Door Frame	Brick	Red	Intact	Inconclusive	1.12	0.1
8/3/2022	589	Basement By Front St	Door Frame	Brick	Red	Intact	Inconclusive	0.69	0.37
8/3/2022	590	Basement By Front St	Door Frame	Brick	Red	Intact	Inconclusive	<LOD	0.86
8/3/2022	591	Basement By Front St	Door Frame	Brick	Red	Intact	Inconclusive	0.98	0.27
8/3/2022	592	Basement By Front St	Door Frame	Brick	Red	Intact	Inconclusive	<LOD	0.92
8/3/2022	593	Basement By Front St	Door Frame	Brick	Red	Intact	Inconclusive	1.16	0.11
8/3/2022	**594**	**Basement By Front St**	**Door Frame**	**Brick**	**Red**	**Poor**	**Positive**	**1.36**	**0.22**
8/3/2022	595	Basement By Front St	Door Header	Brick	Red	Intact	Negative	0.41	0.26
8/3/2022	596	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	1.24	0.2
8/3/2022	597	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	1.08	0.19
8/3/2022	598	Basement By Front St	Door Frame	Metal	Red	Intact	Inconclusive	1.02	0.24
8/3/2022	**599**	**Basement By Front St**	**Door Frame**	**Metal**	**Red**	**Poor**	**Positive**	**1.89**	**0.54**
8/3/2022	600	Basement By Front St	Door Header	Metal	Red	Intact	Inconclusive	1.17	0.23
8/3/2022	601	Basement By Front St	Door Header	Metal	Red	Intact	Inconclusive	1.27	0.69
8/3/2022	602	Basement By Front St	Door Header	Wood	Red	Intact	Inconclusive	1.24	0.19
8/3/2022	603	Basement By Front St	Door Header	Wood	Red	Intact	Inconclusive	0.6	0.31
8/3/2022	604	Basement By Front St	Door Header	Wood	Red	Intact	Inconclusive	<LOD	1.17
8/3/2022	605	Basement By Front St	Door Header	Wood	Red	Intact	Inconclusive	<LOD	1.37

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	606	Basement By Front St	Door Header	Wood	Red	Intact	Inconclusive	1.2	0.57
8/3/2022	607	Basement By Front St	Door Jamb	Wood	Blue	Intact	Negative	0.55	0.27
8/3/2022	608	Basement By Front St	Door Jamb	Wood	Blue	Intact	Inconclusive	0.62	0.33
8/3/2022	**609**	**Basement By Front St**	**Door Jamb**	**Metal**	**Red**	**Fair**	**Positive**	**1.38**	**0.24**
8/3/2022	**610**	**Basement By Front St**	**Door Jamb**	**Metal**	**Red**	**Fair**	**Positive**	**1.53**	**0.33**
8/3/2022	611	Basement By Front St	Door Header	Wood	Red	Intact	Inconclusive	1.01	0.1
8/3/2022	612	Basement By Front St	Door Frame	Wood	Red	Intact	Inconclusive	2.23	1.07
8/3/2022	613	Basement By Front St	Door Frame	Wood	Red	Intact	Inconclusive	1.22	0.28
8/3/2022	614	Basement By Front St	Door Frame	Wood	Red	Intact	Negative	0.52	0.27
8/3/2022	**615**	**Basement By Front St**	**Door**	**Wood**	**Red**	**Fair**	**Positive**	**1.53**	**0.27**
8/3/2022	**616**	**Basement By Front St**	**Door**	**Wood**	**Red**	**Fair**	**Positive**	**1.26**	**0.11**
8/3/2022	617	Basement By Front St	Wall	Concrete	Beige	Intact	Inconclusive	0.81	0.18
8/3/2022	**618**	**Basement By Front St**	**Wall**	**Concrete**	**Beige**	**Fair**	**Positive**	**3.06**	**0.99**
8/3/2022	**619**	**Basement By Front St**	**Wall**	**Concrete**	**Beige**	**Fair**	**Positive**	**6.79**	**0.82**
8/3/2022	**620**	**Basement By Front St**	**Wall**	**Concrete**	**Beige**	**Fair**	**Positive**	**22.8**	**2.75**
8/3/2022	621	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.04
8/3/2022	622	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.07
8/3/2022	623	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.09
8/3/2022	624	Basement By Front St	Wall	Brick	Beige	Intact	Negative	<LOD	0.01
8/3/2022	625	Basement By Front St	Wall	Concrete	Gray	Intact	Negative	<LOD	0.07
8/3/2022	626	Basement By Front St	Wall	Concrete	Gray	Intact	Negative	<LOD	0.12
8/3/2022	627	Basement By Front St	Wall	Brick	Gray	Intact	Negative	<LOD	0.05
8/3/2022	628	Basement By Front St	Wall	Concrete	White	Intact	Negative	<LOD	0.09
8/3/2022	629	Basement By Front St	Wall	Concrete	White	Intact	Negative	<LOD	0.1
8/3/2022	630	Basement By Front St	Door	Concrete	White	Intact	Negative	<LOD	0.32
8/3/2022	631	Basement By Front St	Door	Wood	White	Intact	Negative	<LOD	0.34
8/3/2022	632	Basement By Front St	Door Frame	Wood	White	Intact	Inconclusive	0.69	0.41
8/3/2022	633	Basement By Front St	Door Frame	Wood	White	Intact	Negative	<LOD	0.43

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	634	Basement By Front St	Door Frame	Wood	White	Intact	Inconclusive	<LOD	0.84
8/3/2022	635	Basement By Front St	Door Frame	Wood	White	Intact	Negative	<LOD	0.35
8/3/2022	636	Basement By Front St	Door Frame	Metal	Red	Intact	Negative	<LOD	0.13
8/3/2022	637	Basement By Front St	Door Frame	Metal	Red	Intact	Negative	<LOD	0.21
8/3/2022	638	Basement By Front St	Door Jamb	Metal	Red	Intact	Negative	<LOD	0.13
8/3/2022	639	Basement By Front St	Door	Metal	Gray	Intact	Negative	<LOD	0.01
8/3/2022	640	Basement By Front St	Wall	Concrete	Tan	Intact	Inconclusive	<LOD	1.02
8/3/2022	641	Basement By Front St	Wall	Concrete	Tan	Intact	Inconclusive	<LOD	1.01
8/3/2022	642	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.51
8/3/2022	643	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.11
8/3/2022	644	Basement By Front St	Tread	Concrete	Black	Intact	Negative	<LOD	0.03
8/3/2022	645	Basement By Front St	Fireplace	Concrete	Gray	Intact	Negative	<LOD	0.03
8/3/2022	646	Basement By Front St	Floor	Concrete	Gray	Intact	Negative	<LOD	0.08
8/3/2022	647	Basement By Front St	Wall	Concrete	Gray	Intact	Negative	<LOD	0.16
8/3/2022	648	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.17
8/3/2022	649	Basement By Front St	Wall	Brick	Tan	Intact	Negative	<LOD	0.02
8/3/2022	650	Basement By Front St	Wall	Brick	Tan	Intact	Negative	<LOD	0.01
8/3/2022	651	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.44
8/3/2022	652	Basement By Front St	Wall	Concrete	Tan	Intact	Negative	<LOD	0.01
8/3/2022	**653**	**Basement By Front St**	**Wall**	**Concrete**	**Tan**	**Poor**	**Positive**	**4.98**	**2.23**
8/3/2022	**654**	**Basement By Front St**	**Wall**	**Concrete**	**Tan**	**Poor**	**Positive**	**6.73**	**2.44**
8/3/2022	655	Basement By Front St	Wall	Concrete	Tan	Poor	Negative	<LOD	0.06
8/3/2022	656	Basement By Front St	Wall	Concrete	Tan	Poor	Negative	<LOD	0.09
8/3/2022	657	Basement By Front St	Wall	Concrete	Tan	Poor	Negative	<LOD	0.13
8/3/2022	**658**	**Basement By Front St**	**Wall**	**Concrete**	**Tan**	**Poor**	**Positive**	**4.52**	**0.85**
8/3/2022	659	Basement By Front St	Door Jamb	Concrete	Blue	Intact	Negative	0.46	0.29
8/3/2022	660	Basement By Front St	Door Frame	Concrete	Blue	Intact	Negative	<LOD	0.08
8/3/2022	661	Basement By Front St	Door Header	Concrete	White	Intact	Positive	1.65	0.32

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Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	**662**	**Basement By Front St**	**Door Header**	**Metal**	**White**	**Fair**	**Positive**	**1.29**	**0.11**
8/3/2022	**663**	**Basement By Front St**	**Door Header**	**Metal**	**White**	**Fair**	**Positive**	**1.64**	**0.31**
8/3/2022	664	Basement By Front St	Door Frame	Metal	White	Intact	Inconclusive	1.05	0.24
8/3/2022	665	Basement By Front St	Door Frame	Metal	White	Intact	Negative	<LOD	0.38
8/3/2022	666	Basement By Front St	Door Frame	Metal	White	Intact	Inconclusive	1.4	0.31
8/3/2022	667	Basement By Front St	Door Frame	Metal	White	Intact	Inconclusive	0.83	0.37
8/3/2022	668	Basement By Front St	Column	Brick	Beige	Intact	Negative	<LOD	0.06
8/3/2022	669	Basement By Front St	Column	Brick	Beige	Intact	Negative	<LOD	0.06
8/3/2022	670	Basement By Front St	Column	Brick	Beige	Intact	Negative	<LOD	0.07
8/3/2022	671	Basement By Front St	Column	Brick	Beige	Intact	Negative	<LOD	0.03
8/3/2022	672	Basement By Front St	Wall	Brick	Beige	Intact	Negative	<LOD	0.06
8/3/2022	673	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.1
8/3/2022	674	Basement By Front St	Wall	Wood	Beige	Intact	Negative	<LOD	0.08
8/3/2022	675	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.03
8/3/2022	676	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.01
8/3/2022	677	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.07
8/3/2022	678	Basement By Front St	Floor	Concrete	Gray	Intact	Negative	<LOD	0.13
8/3/2022	679	Basement By Front St	Wall	Concrete	Beige	Intact	Negative	<LOD	0.04
8/3/2022	680	Basement By Front St	Wall	Brick	Beige	Intact	Negative	<LOD	0.04
8/3/2022	681	Basement By Front St	Wall	Brick	Beige	Intact	Negative	<LOD	0.03
8/3/2022	682	Basement By Front St	Wall	Brick	Beige	Intact	Negative	<LOD	0.12
8/3/2022	683	Basement By Front St	Wall	Brick	Green	Intact	Negative	<LOD	0.03
8/3/2022	684	Basement By Front St	Wall	Concrete	Green	Intact	Negative	<LOD	0.04
8/3/2022	685	Basement By Front St	Wall	Concrete	Green	Intact	Negative	<LOD	0.01
8/3/2022	686	Basement By Front St	Door	Concrete	White	Intact	Negative	<LOD	0.1
8/3/2022	687	Basement By Front St	Door	Wood	White	Intact	Negative	<LOD	0.08
8/3/2022	688	Basement By Front St	Door Frame	Wood	White	Intact	Negative	<LOD	0.01
8/3/2022	689	Basement By Front St	Door Jamb	Wood	White	Intact	Negative	<LOD	0.02

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8/3/2022	690	Basement By Front St	Window Sill	Wood	White	Intact	Negative	<LOD	0.09
8/3/2022	691	Basement By Back St	Door	Metal	Blue	Intact	Negative	<LOD	0.03
8/3/2022	692	Basement By Back St	Door Frame	Metal	Blue	Intact	Negative	<LOD	0.01
8/3/2022	693	Basement By Back St	Door Jamb	Metal	Blue	Intact	Negative	<LOD	0.04
8/3/2022	694	Basement By Back St	Wall	Brick	Beige	Intact	Negative	<LOD	0.01
8/3/2022	695	Basement By Back St	Wall	Brick	Beige	Intact	Negative	<LOD	0.01
8/3/2022	696	Basement By Back St	Tread	Brick	Black	Intact	Negative	<LOD	0.08
8/3/2022	697	Basement By Back St	Tread	Brick	Black	Intact	Negative	<LOD	0.05
8/3/2022	698	Basement By Back St	Floor	Brick	Gray	Intact	Negative	<LOD	0.05
8/3/2022	699	Basement By Back St	Floor	Concrete	Gray	Intact	Negative	<LOD	0.09
8/3/2022	700	Basement By Back St	Tread	Metal	Black	Intact	Negative	<LOD	0.1
8/3/2022	701	Basement By Back St	Tread	Metal	Black	Intact	Negative	<LOD	0.04
8/3/2022	**702**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**4.67**	**1.49**
8/3/2022	703	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1.72
8/3/2022	704	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	2.99
8/3/2022	705	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	2.15
8/3/2022	706	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	3.01
8/3/2022	707	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1.87
8/3/2022	**708**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**6.48**	**2.66**
8/3/2022	**709**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**3.68**	**1.5**
8/3/2022	710	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1.8
8/3/2022	711	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1
8/3/2022	712	Basement By Back St	Wall	Brick	Beige	Intact	Inconclusive	<LOD	1.07
8/3/2022	**713**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**6.17**	**2.52**
8/3/2022	**714**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**6.2**	**2.52**
8/3/2022	**715**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**3.9**	**1.56**
8/3/2022	**716**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**4.14**	**1.15**
8/3/2022	**717**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**5.23**	**1.92**

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8/3/2022	**718**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**4.96**	**1.76**
8/3/2022	**719**	**Basement By Back St**	**Wall**	**Brick**	**Beige**	**Fair**	**Positive**	**5.56**	**1.82**
8/3/2022	720	Basement By Back St	Wall	Brick	Green	Intact	Inconclusive	<LOD	1.47
8/3/2022	721	Basement By Back St	Wall	Brick	Green	Intact	Negative	<LOD	0.16
8/3/2022	722	Basement By Back St	Wall	Brick	Green	Intact	Negative	<LOD	0.51
8/3/2022	723	Basement By Back St	Wall	Brick	Green	Intact	Inconclusive	<LOD	1.15
8/3/2022	724	Basement By Back St	Wall	Brick	Green	Intact	Inconclusive	<LOD	2.28
8/3/2022	725	Basement By Back St	Wall	Brick	Green	Intact	Negative	<LOD	0.82
8/3/2022	726	Basement By Back St	Wall	Brick	Green	Intact	Inconclusive	<LOD	2.09
8/3/2022	727	Basement By Back St	Wall	Brick	Green	Intact	Inconclusive	<LOD	1.2
8/3/2022	**728**	**Basement By Back St**	**Wall**	**Brick**	**Green**	**Poor**	**Positive**	**4.31**	**1.58**
8/3/2022	729	Basement By Back St	Wall	Brick	Green	Intact	Negative	0.57	0.21
8/3/2022	730	Basement By Back St	Wall	Brick	White	Intact	Negative	<LOD	0.49
8/3/2022	**731**	**Basement By Back St**	**Wall**	**Brick**	**White**	**Fair**	**Positive**	**4.26**	**1.59**
8/3/2022	**732**	**Basement By Back St**	**Wall**	**Brick**	**White**	**Fair**	**Positive**	**2.05**	**0.52**
8/3/2022	733	Basement By Back St	Wall	Brick	White	Intact	Negative	<LOD	0.16
8/3/2022	734	Basement By Back St	Wall	Brick	White	Intact	Negative	0.05	0.02
8/3/2022	**735**	**Basement By Back St**	**Wall**	**Brick**	**White**	**Fair**	**Positive**	**2.6**	**0.92**
8/3/2022	**736**	**Basement By Back St**	**Wall**	**Brick**	**White**	**Fair**	**Positive**	**4.02**	**1.21**
8/3/2022	737	Basement By Back St	Wall	Brick	White	Intact	Inconclusive	<LOD	1.67
8/3/2022	738	Basement By Back St	Wall	Brick	White	Intact	Negative	<LOD	0.33
8/3/2022	739	Basement By Back St	Wall	Brick	White	Intact	Negative	<LOD	0.51
8/3/2022	**740**	**Basement By Back St**	**Wall**	**Brick**	**White**	**Fair**	**Positive**	**2.89**	**0.85**
8/3/2022	741	Basement By Back St	Wall	Brick	White	Intact	Inconclusive	<LOD	1.59
8/3/2022	742	Basement By Back St	Wall	Brick	White	Intact	Inconclusive	<LOD	1.01
8/3/2022	743	Basement By Back St	Wall	Brick	White	Intact	Negative	<LOD	0.44
8/3/2022	744	Basement By Back St	Wall	Brick	White	Intact	Negative	0.07	0.01
8/3/2022	745	Basement By Back St	Wall	Brick	White	Intact	Inconclusive	<LOD	1.41

<LOD = Less than the Level of Detection (not LBP)

MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	746	Basement By Back St	Wall	Brick	White	Intact	Negative	<LOD	0.57
8/3/2022	747	Basement By Back St	Wall	Brick	White	Intact	Inconclusive	1.1	0.14
8/3/2022	**748**	**Basement By Back St**	**Wall**	**Brick**	**Yellow**	**Fair**	**Positive**	**2.95**	**1.27**
8/3/2022	749	Basement By Back St	Wall	Concrete	Beige	Intact	Negative	0.33	0.13
8/3/2022	750	Basement By Back St	Wall	Concrete	Beige	Intact	Negative	0.42	0.18
8/3/2022	751	Basement By Back St	Window Frame	Wood	Green	Intact	Negative	0.51	0.32
8/3/2022	752	Basement By Back St	Window Frame	Wood	Green	Intact	Inconclusive	0.69	0.23
8/3/2022	753	Basement By Back St	Window Frame	Wood	Green	Intact	Inconclusive	0.87	0.1
8/3/2022	754	Basement By Back St	Window Frame	Wood	Green	Intact	Inconclusive	0.77	0.17
8/3/2022	755	Basement By Back St	Window Frame	Wood	Green	Intact	Inconclusive	1.49	0.61
8/3/2022	756	Basement By Back St	Window Sill	Wood	Green	Intact	Negative	<LOD	0.14
8/3/2022	757	Basement By Back St	Column	Wood	Green	Intact	Negative	<LOD	0.04
8/3/2022	758	Basement By Back St	Door	Wood	Green	Intact	Negative	<LOD	0.06
8/3/2022	759	Basement By Back St	Door	Wood	Green	Intact	Negative	<LOD	0.02
8/3/2022	760	Basement By Back St	Door Frame	Wood	Green	Intact	Negative	<LOD	0.11
8/3/2022	**761**	**Basement By Back St**	**Door Jamb**	**Wood**	**White**	**Fair**	**Positive**	**5.19**	**1.55**
8/3/2022	**762**	**Basement By Back St**	**Door Jamb**	**Wood**	**White**	**Fair**	**Positive**	**10.62**	**3.72**
8/3/2022	**763**	**Basement By Back St**	**Door Jamb**	**Wood**	**White**	**Fair**	**Positive**	**5.41**	**1.88**
8/3/2022	764	Basement By Back St	Door Jamb	Wood	White	Intact	Negative	<LOD	0.02
8/3/2022	**765**	**Basement By Back St**	**Door Jamb**	**Wood**	**White**	**Fair**	**Positive**	**4.77**	**1.82**
8/3/2022	**766**	**Basement By Back St**	**Stringer**	**Wood**	**Gray**	**Fair**	**Positive**	**6.3**	**2.79**
8/3/2022	**767**	**Basement By Back St**	**Stringer**	**Wood**	**Gray**	**Fair**	**Positive**	**7.77**	**2.24**
8/3/2022	768	Basement By Back St	Stringer	Wood	Gray	Intact	Inconclusive	<LOD	1.29
8/3/2022	**769**	**Basement By Back St**	**Stringer**	**Metal**	**Gray**	**Fair**	**Positive**	**4.13**	**1.06**
8/3/2022	770	Basement By Back St	Railing	Metal	Gray	Intact	Inconclusive	<LOD	0.66
8/3/2022	771	Basement By Back St	Railing	Metal	Gray	Intact	Inconclusive	<LOD	1
8/3/2022	772	Basement By Back St	Railing	Metal	Gray	Intact	Inconclusive	<LOD	1.58
8/3/2022	773	Basement By Back St	Railing	Metal	Gray	Intact	Inconclusive	<LOD	0.89

<LOD = Less than the Level of Detection (not LBP)

MONTROSE ENVIRONMENTAL

Table 2
XRF Testing Results
Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

Date	Reading	Room	Component	Substrate	Paint Color	Paint Condition	Result	Lead Content (mg/cm^2)	Lead +/- (Range)
8/3/2022	774	Basement By Back St	Railing	Metal	Gray	Intact	Negative	<LOD	0.39
8/3/2022	775	Basement By Back St	Railing	Metal	Gray	Intact	Inconclusive	<LOD	2.53
8/3/2022	**776**	**Basement By Back St**	**Railing**	**Metal**	**Gray**	**Intact**	**Positive**	**4.75**	**1.65**
8/3/2022	777	Basement By Back St	Railing	Metal	Gray	Intact	Negative	<LOD	0.14
8/3/2022	**778**	**Basement By Back St**	**Railing**	**Metal**	**Gray**	**Intact**	**Positive**	**2.49**	**0.65**
8/3/2022	779	Calibration			Red	Intact	Inconclusive	1.13	0.1
8/3/2022	780	Calibration			Red	Intact	Positive	1.2	0.1
8/3/2022	781	Calibration			Red	Intact	Inconclusive	1.13	0.1

<LOD = Less than the Level of Detection (not LBP)

TABLE 3

Paint Chip Sample Results

MONTROSE ENVIRONMENTAL

Table 3
Paint Chip Sample Results
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Sample ID	Date	Location, Color / Description	Lead Chip Concentration Indicative of Lead Hazard (% by weight)	Chip Sample Result (% by weight)
GISL-1	7/28/2022	3rd FL Hall Beige Window Sills	0.500%	0.012%
GISL-2	7/28/2022	3rd FL Hall Gray Baseboard	0.500%	<0.0080%
GISL-3	7/28/2022	Room 310 Beige Wall	0.500%	0.010%
GISL-4	7/28/2022	North Stairwell Beige Wall	0.500%	0.23%
GISL-5	7/28/2022	Room 305 Beige Wall	0.500%	0.19%
GISL-6	7/28/2022	Room 306 Beige Bay Window	0.500%	0.048%
GISL-7	**7/28/2022**	**Room 304 Beige Window**	**0.500%**	**1.50%**
GISL-8	7/28/2022	Room 303 Beige Window Sill	0.500%	0.47%
GISL-9	7/29/2022	Room 217 Beige Wall	0.500%	0.29%
GISL-10	7/29/2022	Room 219 Beige Wood Trim	0.500%	0.078%
GISL-11	7/29/2022	2nd FL North Hall Beige Wall	0.500%	<0.0080%
GISL-12	7/29/2022	Room 215 Aqua Door	0.500%	0.110%
GISL-13	7/29/2022	North Hall Stairwell Beige Wall	0.500%	<0.0080%
GISL-14	7/29/2022	Room 200 Beige Window Sill	0.500%	0.094%
GISL-15	**7/29/2022**	**Exterior Door #01 White**	**0.500%**	**16.00%**
GISL-16	7/28/2022	Room 116 Hall Beige Wall	0.500%	<0.0080%
GISL-17	8/2/2022	Library Room 112 Beige Wall	0.500%	0.21%
GISL-18	8/2/2022	Hallway by Room 112 Mustard Beige Wall	0.500%	<0.0080%
GISL-19	8/2/2022	Room 109 Beige Wall	0.500%	<0.0080%
GISL-20	8/2/2022	Room 110-3 Beige Ceiling	0.500%	0.49%
GISL-21	8/2/2022	Staff Dining Room 105 Beige Wall	0.500%	0.074%
GISL-22	8/2/2022	Cafeteria Room 104 Beige Wall	0.500%	0.10%
GISL-23	8/2/2022	Hallway by Room 103 Gray Floor	0.500%	0.015%

Table 3
Paint Chip Sample Results
Pre-Renovation Hazardous Materials Survey
Glassboro Intermediate School

Sample ID	Date	Location, Color / Description	Lead Chip Concentration Indicative of Lead Hazard (% by weight)	Chip Sample Result (% by weight)
GISL-24	8/2/2022	Hallway by Room 106 Beige Wall	0.500%	0.34%
GISL-25	8/2/2022	Kitchen White Wall	0.500%	0.21%
GISL-26	8/2/2022	Hallway by Room 100	0.500%	0.35%
GISL-27	8/2/2022	Basement by Back-Street Gray Floor	0.500%	0.19%
GISL-28	8/2/2022	Basement by Back-Street Green Wall	0.500%	<0.0080%
GISL-29	8/2/2022	Basement by Back-Street Hallway White Wall	0.500%	0.31%
GISL-30	8/2/2022	Basement by Back-Street Gray Baseboard	0.500%	0.20%
GISL-31	**8/2/2022**	**Basement by Street White Door**	**0.500%**	**1.20%**
GISL-32	**8/2/2022**	**Basement by Street Red Door**	**0.500%**	**2.10%**

0.50% = Exceeds lead in paint concentration by weight

Appendix A

Licenses and Certifications

60111

NAETI Inc.

CERTIFICATE OF COMPLETION

This is to certify that

Julian Fernandez-Obregon

Successfully completed the course entitled

1-Day New Jersey/Lead Inspector/Risk Assessor Refresher on July 26th, 2021

Examination Passed on July 26th, 2021 *Expiration Date July 26th, 2023*

Lee Wasserman
President, NAETI Inc.

Language: English | 3 CE Units | ABIH 1 CM POINT

3321 Doris Avenue, Building B, Ocean, NJ 07712 **Phone (732) 531-5571** **Fax (732) 531-5956** **www.naeti.com**

59810

True Copy BM

NAETI Inc.

CERTIFICATE OF COMPLETION

AHERA/EPA Accredited Per 40 CFR Part 763
Asbestos Accreditation under TSCA Title II

Julian Fernandez-Obregon

Successfully completed the course entitled

1/2-Day New York State/EPA/AHERA Asbestos Building Inspector Annual Refresher on October 4th, 2021

Examination Passed on October 4th, 2021

Expiration Date on October 4th, 2022

Lee Wasserman
President, NAETI Inc.

Per 10 NYCRR Part 73.2 (L) (1). DOH 2832 Certificate of Completion of Asbestos Safety Training is the only official record of training for N.Y.S. students.

Language: English

ABIH 1/2 CM POINT

3321 Doris Avenue, Building B, Ocean, NJ 07712 **Phone (732) 531-5571** **Fax (732) 531-5956** **www.naeti.com**

Lead Identification Permit

New Jersey Department of Health

JULIAN M FERNANDEZ-OBREGON

Permit No.: 037807

ID No.: 026991

Expires: 8/28/2023

Authorization Signature:

Christina Tan, MD, M.P.H., Assistant Commissioner

Inspector/Risk Assessor

62313

NAETI Inc.

CERTIFICATE OF COMPLETION

AHERA/EPA Accredited Per 40 CFR Part 763
Asbestos Accreditation under TSCA Title II

This is to certify that

Collin Oriente

Successfully completed the course entitled

3-Day New York State/EPA/AHERA Asbestos Building Inspector Program on June 1st -3rd, 2022

Examination passed on June 3rd, 2022

Expiration Date on June 3rd, 2023

Steve Leon

Training Director , NAETI Inc.

Per 10 NYCRR Part 73.2 (L) (1), DOH 2832 Certificate of Completion of Asbestos Safety Training is the only official record of training for N.Y.S. students.

Language: English

ABIH 3 CM POINTS

3321 Doris Avenue, Building B, Ocean, NJ 07712 Phone (732) 531-5571 Fax (732) 531-5956 www.naeti.com

Name: MARISSA P WEINSTEIN

ID Number: 038032

P THESE INSTRUCTIONS FOR YOUR RECORDS. Please verify the
must have your permit at the job site and readily available for inspection by

partment of Health
d Occupational Health
ox 372
08625-0372
26-4950

This PERMIT has been issued in accordance with N.J.A.C. 8:62. You MUST have this PERMIT with you any time you are performing work for which it is required. Failure to carry this PERMIT or altering or falsifying this PERMIT may result in a civil administrative PENALTY of up to $1,000 per day for the first offense and up to $5,000/day for each subsequent offense. Each day shall constitute an additional and separate offense.

To report a lost or stolen PERMIT, defects to a PERMIT, or to find out how to renew a PERMIT, contact the NJ DOH (see below).

E-mail: iep.program@doh.nj.gov Telephone: 609-826-4950
Web: www.state.nj.us/health/eohap Fax: 609-826-4975
Address: NJ DOH, CEOHS, EOHAP
PO Box 372, Trenton, NJ 08625-0372

If this PERMIT is found abandoned, please send to the above address.

Issued By	*Card Number*	*Issue Date*
JF	**038032-1**	***4/28/2022***

E INSTRUCTIONS FOR YOUR RECORDS. Please verify the
e your permit

Co
Ex
Permit

Lead Identification Permit

New Jersey Department of Health

MARISSA P WEINSTEIN

Permit No.: 038032

ID No.: 038032

Expires: 4/28/2024

Authorization Signature: Christina Tan

Christina Tan, MD, M.P.H., Assistant Commissioner

Inspector/Risk Assessor

62037

NAETI Inc.

True Copy
BM

CERTIFICATE OF COMPLETION

AHERA/EPA Accredited Per 40 CFR Part 763
Asbestos Accreditation under TSCA Title II

Marissa Weinstein

Successfully completed the course entitled

1/2-Day EPA/AHERA Asbestos Building Inspector Annual Refresher on April 4th, 2022

Expiration Date on April 4th, 2023

Steve Leon
Training Director, NAETI Inc.

Per 10 NYCRR Part 73.2 (L) (1), DOH 2832 Certificate of Completion of Asbestos Safety Training is the only official record of training for N.Y.S. students.

Language: English

ABIH 1/2 CM POINT

3321 Doris Avenue, Building B, Ocean, NJ 07712 **Phone (732) 531-5571** **Fax (732) 531-5956** **www.naeti.com**

61553

NAETI Inc.

True Copy BM

CERTIFICATE OF COMPLETION

This is to certify that

Marissa Weinstein

Successfully completed the course entitled

5-Day New Jersey Lead Inspector/Risk Assessor Program on February 21st -25th, 2022

Examination Passed on February 25th, 2022 *Expiration Date on February 25th, 2024*

Steve Leon
Training Director, NAETI Inc.

Language: English ABIH 5 CM POINTS

3321 Doris Avenue, Building B, Ocean, NJ 07712 **Phone (732) 531-5571** **Fax (732) 531-5956** **www.naeti.com**

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 101048-0

EMSL Analytical, Inc.

Cinnaminson, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Asbestos Fiber Analysis

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2022-07-01 through 2023-06-30

Effective Dates

For the National Voluntary Laboratory Accreditation Program

National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Ms. Samantha Rundstrom
Phone: 856-303-2577
Email: srundstrom@emsl.com
http://www.emsl.com

ASBESTOS FIBER ANALYSIS **NVLAP LAB CODE 101048-0**

Bulk Asbestos Analysis

Code	*Description*
18/A01	EPA -- 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples
18/A03	EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials

Airborne Asbestos Analysis

Code	*Description*
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

For the National Voluntary Laboratory Accreditation Program

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

EMSL Analytical, Inc.

200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: 100194

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC accreditation to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories* in the following:

LABORATORY ACCREDITATION PROGRAMS

✓	**INDUSTRIAL HYGIENE**	Accreditation Expires: November 01, 2020
✓	**ENVIRONMENTAL LEAD**	Accreditation Expires: November 01, 2020
✓	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: November 01, 2020
☐	**FOOD**	Accreditation Expires:
☐	**UNIQUE SCOPES**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation**. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2005 and AIHA-LAP, LLC requirements. This certificate is not valid without the attached **Scope of Accreditation**. Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

Beth Bair

Elizabeth Bair
Chairperson, Analytical Accreditation Board

Cheryl O. Morton

Cheryl O. Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision 17 – 09/11/2018

Date Issued: 11/30/2018

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: **100194**
Issue Date: 11/30/2018

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

The EPA recognizes the AIHA-LAP, LLC ELLAP program as meeting the requirements of the National Lead Laboratory Accreditation Program (NLLAP) established under Title X of the Residential Lead-Based Paint Hazard Reduction Act of 1992 and includes paint, soil and dust wipe analysis. Air and composited wipes analyses are not included as part of the NLLAP.

Environmental Lead Laboratory Accreditation Program (ELLAP)

Initial Accreditation Date: 01/18/1995

Field of Testing (FoT)	Technology sub-type/ Detector	Method	Method Description (*for internal methods only*)
Paint		EPA SW-846 3050B	
		EPA SW-846 7000B	
Soil		EPA SW-846 3050B	
		EPA SW-846 7000B	
Settled Dust by Wipe		EPA SW-846 3050B	
		EPA SW-846 7000B	
Airborne Dust		NIOSH 7082	
Composited Wipes		EPA SW-846 3050B	
		EPA SW-846 7000B	

A complete listing of currently accredited Environmental Lead laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077

Laboratory ID: LAP-100194

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC accreditation to the ISO/IEC 17025:2017 international standard, General Requirements for the Competence of Testing and Calibration Laboratories in the following:

LABORATORY ACCREDITATION PROGRAMS

☑	**INDUSTRIAL HYGIENE**	Accreditation Expires: November 01, 2022
☑	**ENVIRONMENTAL LEAD**	Accreditation Expires: November 01, 2022
☑	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: November 01, 2022
☐	**FOOD**	Accreditation Expires:
☐	**UNIQUE SCOPES**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached Scope of Accreditation. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2017 and AIHA-LAP, LLC requirements. This certificate is not valid without the attached Scope of Accreditation. Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

Cheryl O. Morton

Cheryl O Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision19: 09/01/2020

Date Issued: 10/31/2020

AIHA Laboratory Accreditation Programs, LLC

SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077

Laboratory ID: LAP-100194
Issue Date: 10/31/2020

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 02/01/1989

IHLAP Scope Category	Field of Testing (FOT)	Technology sub-type/Detector	Published Reference Method/Title of In-house Method	Component, parameter or characteristic tested
Asbestos/Fiber Microscopy Core	Phase Contrast Microscopy (PCM)	-	NIOSH 7400	Asbestos/Fibers
Asbestos/Fiber Microscopy Core	Polarized Light Microscopy (PLM)	-	EPA 600/R-93/116	Asbestos & Other Fibers in Bulk
Asbestos/Fiber Microscopy Core	Transmission Electron Microscopy (TEM)	-	EPA AHERA - 40 CFR Part 763	Asbestos
Asbestos/Fiber Microscopy Core	Transmission Electron Microscopy (TEM)	-	NIOSH 7402	Asbestos/Fibers
Beryllium Testing	Inductively-Coupled Plasma	ICP/AES	NIOSH 7303 Modified	Beryllium
Beryllium Testing	Inductively-Coupled Plasma	ICP/MS	NIOSH 7300 Modified	Beryllium
Chromatography Core	GC/MS	-	EPA TO-15	Volatile Organic Compounds
Chromatography Core	Gas Chromatography	GC/ECD	NIOSH 5502 Modified	Aldrin & Lindane
Chromatography Core	Gas Chromatography	GC/ECD	NIOSH 5503 Modified	Polychlorinated biphenyls
Chromatography Core	Gas Chromatography	GC/ECD	NIOSH 5510 Modified	Chlordane
Chromatography Core	Gas Chromatography	GC/ECD	OSHA 1010 Modified	Ethylene Oxide
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1003 Modified	Halogenated Hydrocarbons
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1005 Modified	Methylene Chloride
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1400 Modified	Alcohols
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1500 Modified	Hydrocarbons
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1501 Modified	Aromatic Hydrocarbons
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1550 Modified	Total Petroleum Hydrocarbons

IHLAP Scope Category	Field of Testing (FOT)	Technology sub-type/Detector	Published Reference Method/Title of In-house Method	Component, parameter or characteristic tested
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1603 Modified	Acetic Acid
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 2000 Modified	Methyl Alcohol
Chromatography Core	Gas Chromatography (Diffusive Samplers)	-	NIOSH 1501	Aromatic Hydrocarbons
Chromatography Core	Ion Chromatography (IC)	-	NIOSH 6004 Modified	Sulfur Dioxide/Sulfate
Chromatography Core	Ion Chromatography (IC)	-	NIOSH 6011	Chlorine & Bromine
Chromatography Core	Ion Chromatography (IC)	-	NIOSH 7903	Inorganic Acids
Chromatography Core	Ion Chromatography (IC)	-	OSHA ID-214	Ozone
Chromatography Core	Ion Chromatography (IC)	-	OSHA ID-215 (Version 2) Modified	Hexavalent Chromium
Chromatography Core	Liquid Chromatography	HPLC/FL	NIOSH 2016	Formaldehyde
Chromatography Core	Liquid Chromatography	HPLC/UV	NIOSH 5506 Modified	Polynuclear Aromatic Hydrocarbons (PAHs)
Chromatography Core	Liquid Chromatography	LC/MS	NIOSH 9111 Modified	Methamphetamines
Miscellaneous Core	Gravimetric	-	NIOSH 0500	Total Dust
Miscellaneous Core	Gravimetric	-	NIOSH 0600	Respirable Dust
Miscellaneous Core	Gravimetric	-	NIOSH 5524	Metal Working Fluids
Miscellaneous Core	Thermo-optical Analysis (TOA)	-	NIOSH 5040	Elemental Carbon
Spectrometry Core	Atomic Absorption	CVAA	NIOSH 6009 Modified	Mercury
Spectrometry Core	Atomic Absorption	CVAA	OSHA ID-140 Modified	Mercury vapor
Spectrometry Core	Atomic Absorption	CVAA	OSHA ID-145	Mercury particulate
Spectrometry Core	Atomic Absorption	FAA	NIOSH 7082	Lead
Spectrometry Core	Atomic Absorption	GFAA	NIOSH 7105	Lead
Spectrometry Core	Inductively-Coupled Plasma	ICP/AES	NIOSH 7300 Modified	Lead
Spectrometry Core	Inductively-Coupled Plasma	ICP/MS	NIOSH 7300 Modified	Lead
Spectrometry Core	UV/VIS (Colorimetric)	-	NIOSH 6010	Hydrogen Cyanide
Spectrometry Core	X-ray Diffraction (XRD)	-	NIOSH 7500	Silica
Spectrometry Core	X-ray Diffraction (XRD)	-	OSHA ID-142	Silica

A complete listing of currently accredited IHLAP laboratories is available on the AIHA-LAP, LLC website at: *http://www.aihaaccreditedlabs.org*

Appendix B

Photo Log of Suspect and Confirmed ACM

Photo 1. S-03, S-04 White and Brown Plaster – 3rd Floor Bathroom

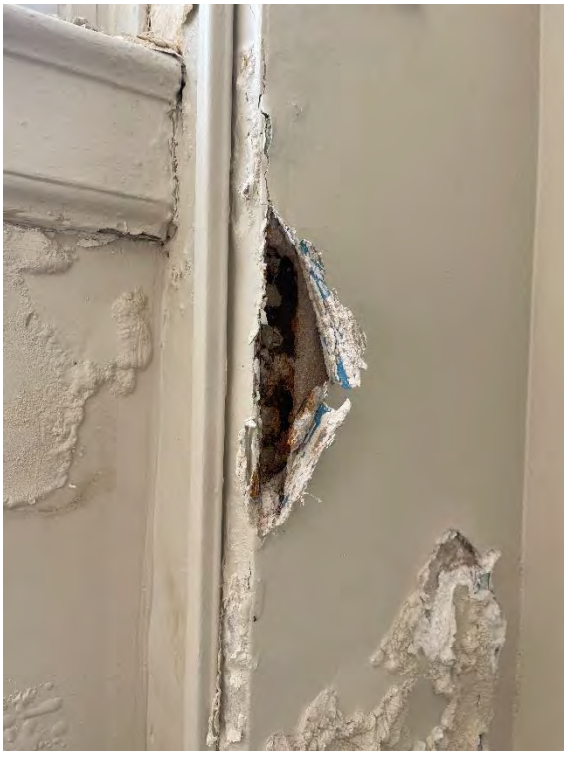

Photo 2. M-02 Plaster Joint Compound – 3rd Floor Bathroom

Photo 3. M-09 Gray with Specks 12x12" Floor Tile - 3rd Floor Rooms

Photo 4. M-12 Blue Baseboard and Mastic – 3rd Floor Rooms

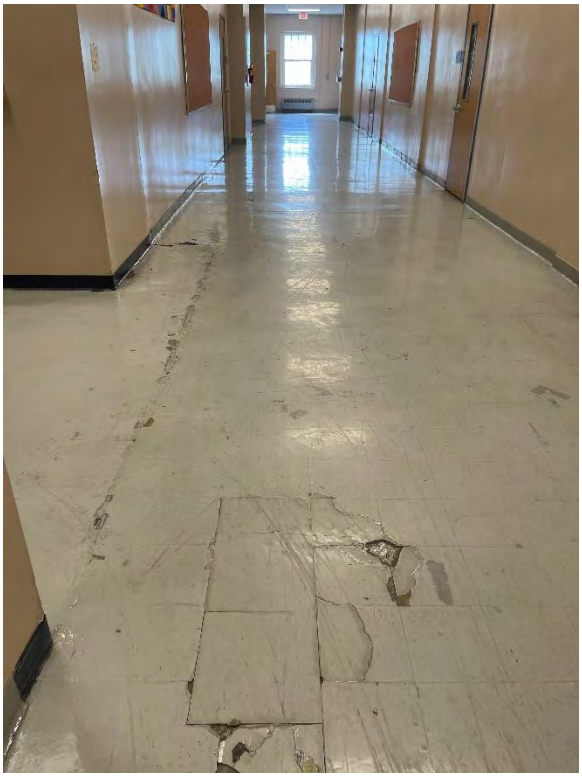

Photo 5. M-17 Brown/Tan 9x9'' Floor Tile – 3rd Floor Hallway

Photo 6. M-21 Drywall – Room 305

Photo 7. M-19, M-22 White and Dark Blue 12x12'' Floor Tile – Room 305

Photo 8. M-07 White and Green 12x12'' Floor Tile – Room 305

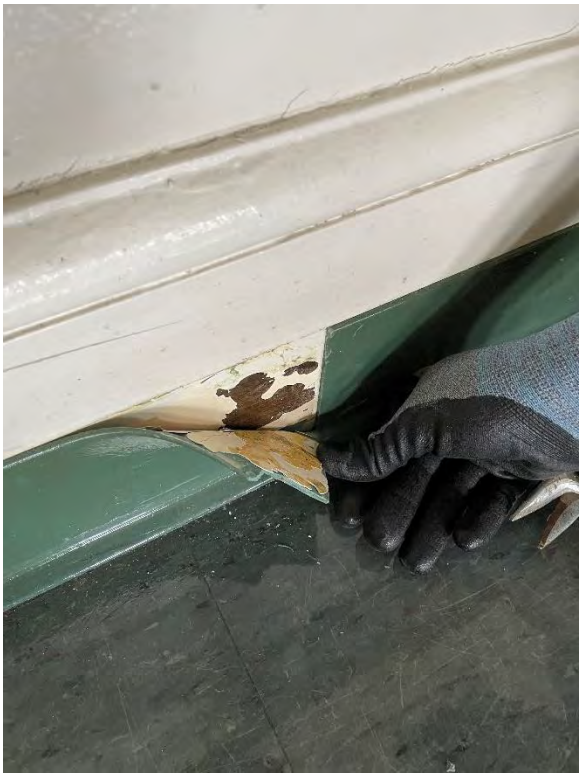

Photo 9. M-05 Green Baseboard and Mastic – 3rd Floor Rooms

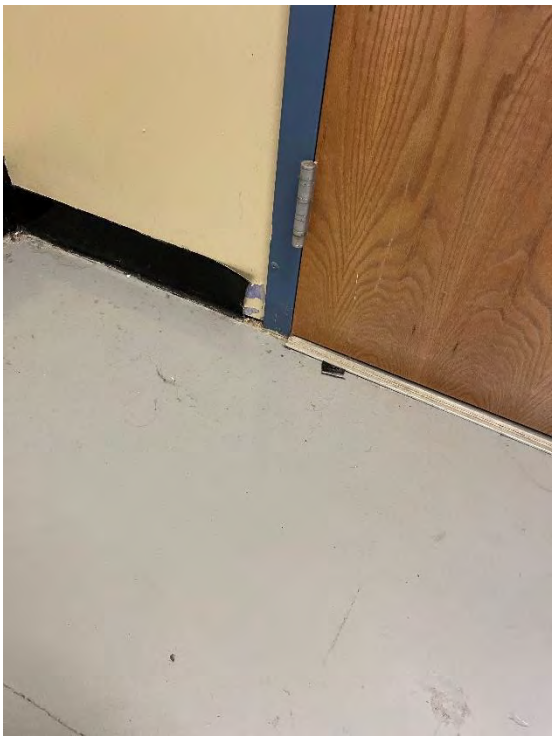

Photo 10. M-25 Black Baseboard and Mastic – 3rd Floor Stairway

Photo 11. M-27 Black Tar – Attic

Photo 12. M-28 Black Sheeting – Attic

Photo 13. M-29 White Caulk -- Attic

Photo 14. M-31 White Floor Tile with Grey Specks 12x12'' –Room 217

Photo 15. M-33 Blue Baseboard and Mastic – Room 217

Photo 16. M-34 Black Baseboard and Mastic –Room 219

Photo 17. M-35 Carpet Mastic – Room 219

Photo 18. M-36 Drywall Joint Compound – Room 219

Photo 19. M-37 Black Glue Tar – Steps Under Stairwell 2nd Floor

Photo 20. M-38 Drywall – Room 217

Photo 21. M-39 White 2x4' Pinhole Ceiling Tile – Hallway Outside 217

Photo 22. M-40 Dark Blue 12x12" Floor Tile – Outside of Elevator

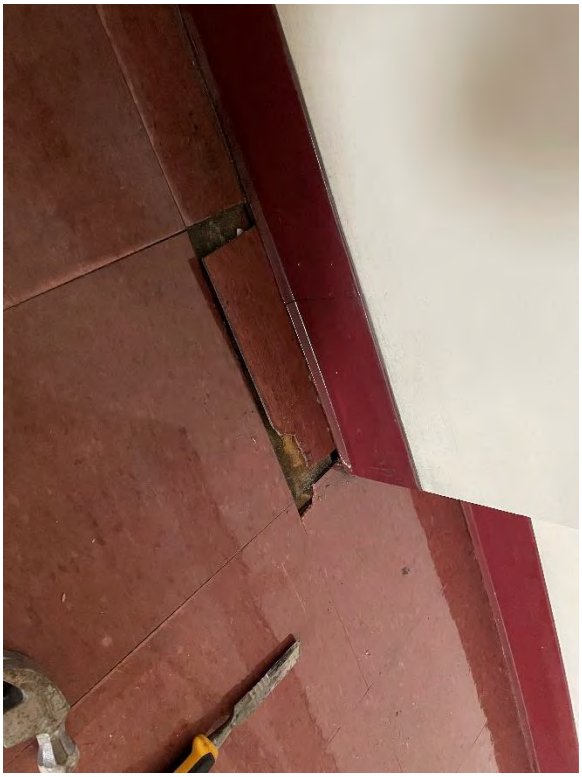

Photo 23. M-43 Red 12x12" Floor Tile – Room 212

Photo 24. M-45 Tan Speckled 12x12" Floor Tile – Room 212

Photo 25. S-47,48 White and Brown Plaster – Steps near stairwell

Photo 26. M-49 Light Blue 12x12" Floor Tile – Room 209/211

Photo 27. M-51 Red Baseboard and Mastic – Room 202

Photo 28. S-52, S-53 Plaster White and Brown – End of Hall South

Photo 29. M-54 Black Counters – Room 200

Photo 30. M-55 Linoleum Black Traction Tread – Hallway South

Photo 31. M-57 Pinhole and Circular Crater 2x4' White Ceiling Tile – Room 215

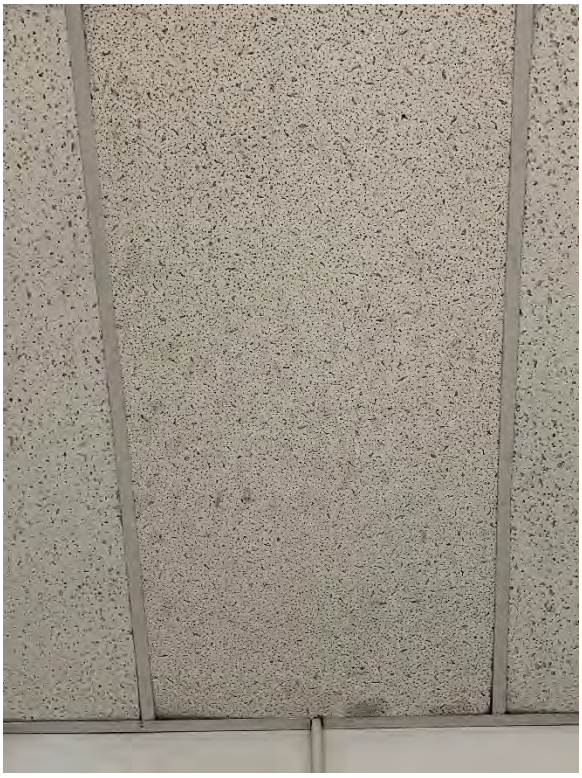

Photo 32. M-58 Pinhole and Oblong Crater 2x4' White Ceiling Tile – Room 215

Photo 33. M-59 Black Sink Undercoating – Room 217

Photo 34. M-62 White Floor Tile with Grey Specks 12x12'' – Room 202

Photo 35. M-64 Red 12x12'' Floor Tile – Room 201

Photo 36. M-66 Drywall – Room 201

Photo 37. M-68 Light Blue 12x12'' Floor Tile – Room 200

Photo 38. M-72, M-74 Dark Blue 12x12'' Floor Tile, White Floor Tile with Grey Specks 12x12''-- Outside Room 114

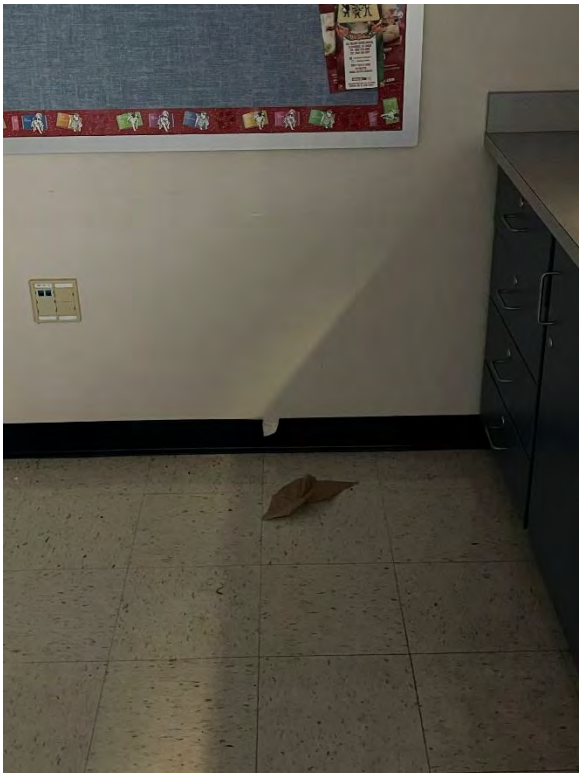

Photo 39. M-77 Blue Baseboard and Mastic – Library

Photo 40. M-78 Carpet Mastic – Library

Photo 41. S-79, S-80 White and Brown Plaster – Library

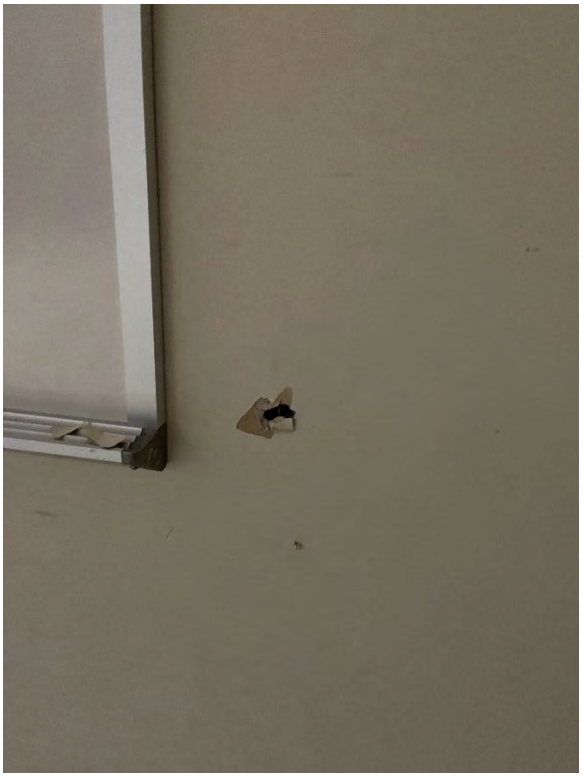

Photo 42. M-81 Drywall – Room 116

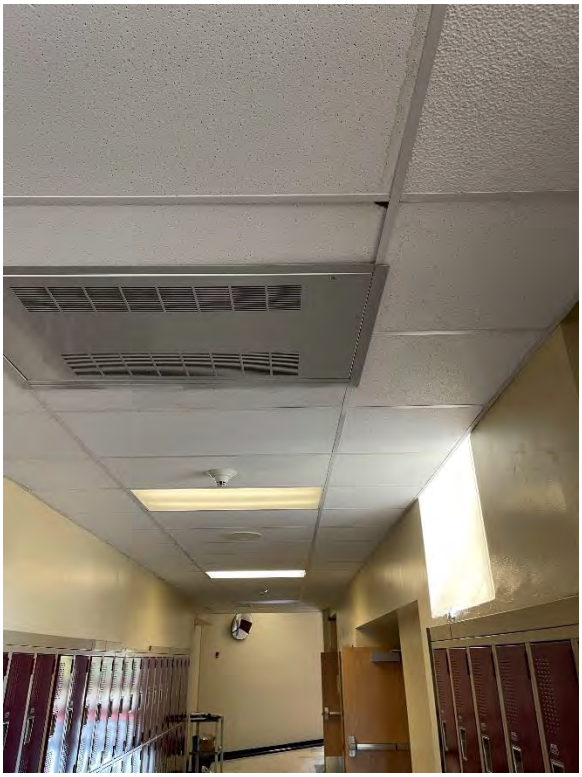

Photo 43. M-82 White Pinhole 2'x4' Ceiling Tile – Hallway Outside Library

Photo 44. M-83 Pinhole with Small Circular Crater White 2'x4' Ceiling Tile – Outside Room 114

Photo 45. M-84 Spray-On Insulation -- Inside Maintenance Closets Library Hallway

Photo 46. M-85 Black Window Ledge – Corridor Before Gym

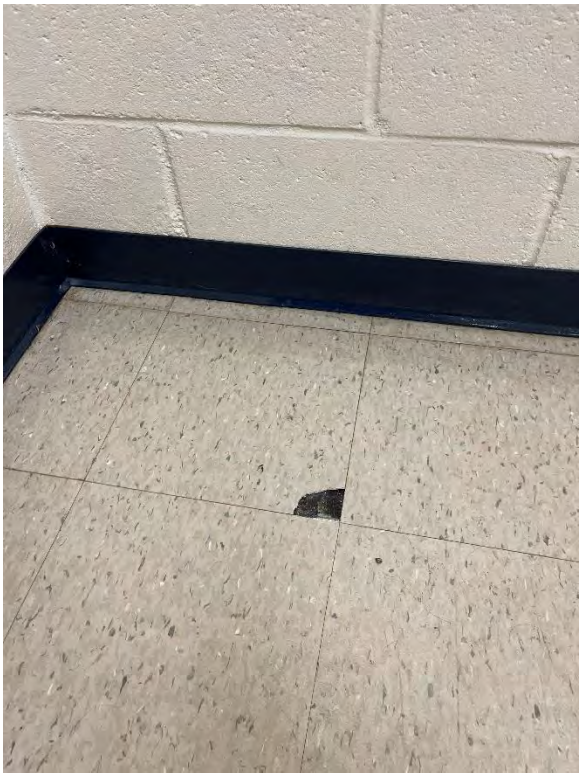

Photo 47. M-86 Tan Speckled 12x12'' Floor Tile -- Locker Room Offices

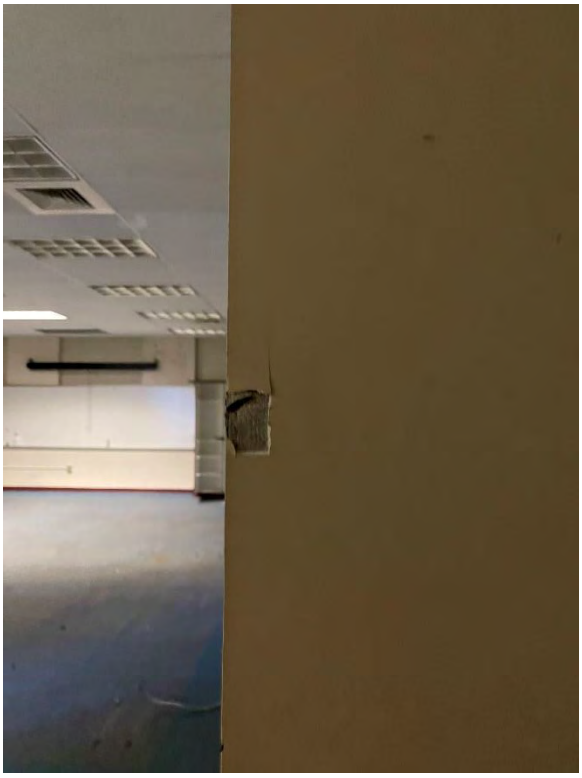

Photo 48. M-88 Joint Compound – Room 114

Photo 49. M-91 Red 12x12'' Floor Tile – Room 109

Photo 50. M-93 Red Baseboard and Mastic – Room 109

Photo 51. M-94 Dark Green with Colored Specks 12"x12" Floor Tile – Room 107

Photo 52. M-96 Green Baseboard – Room 107

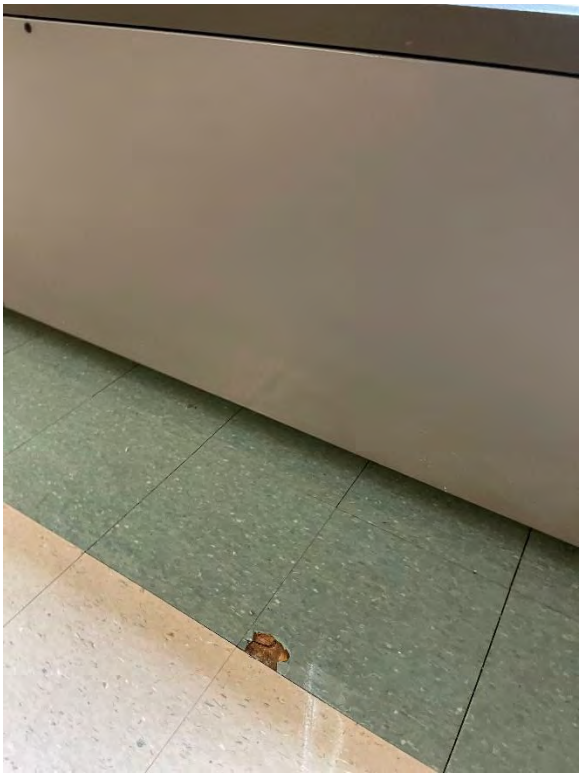

Photo 53. M-98 Light Green with Colored Specks 12"x12" Floor Tile – Staff Dining

Photo 54. M-100 Burgundy Baseboard – Main Office

Photo 55. M-101 Tan with Colored Specks 12x12'' Floor Tile– Staff Dining

Photo 56. M-104 Pinhole 2x4' White Ceiling Tile – North Stairwell

Photo 57. M-109, M-110 White and Brown Plaster – South Stairwell

Photo 58. M-111 Drywall – Main Office

Photo 59. M-112 12x12" Pink Floor Tile – Nurse

Photo 60. M-114 Black Sink Undercoating – Nurse

Photo 61. M-115 Light Green with White Specks 12x12" Floor Tile – Nurse

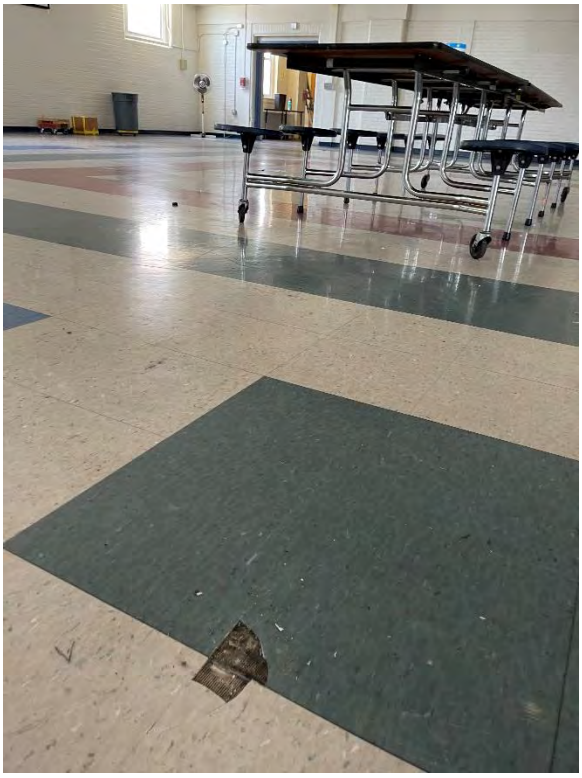

Photo 62. M-122, M-126 Beige Speckled and Green 12x12'' Floor Tile – Cafeteria

Photo 63. M-124 Red 12x12'' Floor Tile – Cafeteria

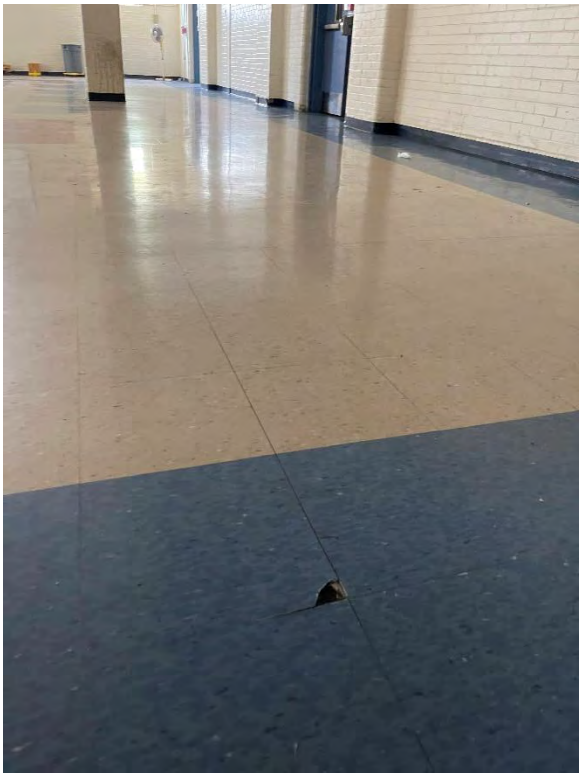

Photo 64. M-128 Blue 12x12" Floor Tile – Cafeteria

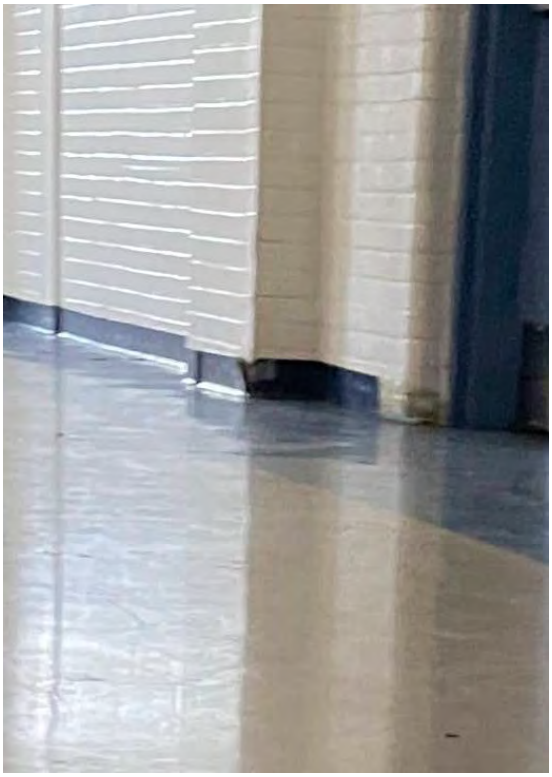

Photo 65. M-130 Blue Baseboard and Mastic – Cafeteria

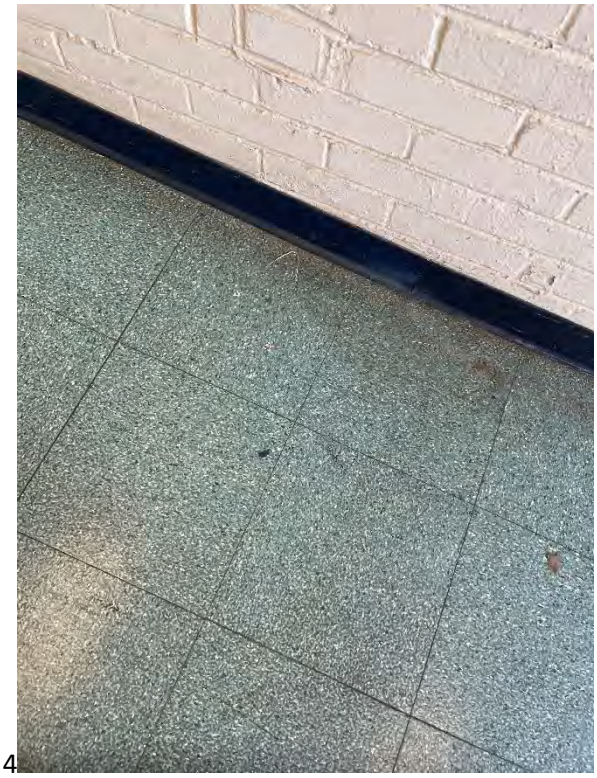

Photo 66. M-132 Teal 12x12" Linoleum Floor Tile – Back Entrance Ramp

Photo 67. M-136 White 2x2' Pinhole Ceiling Tile – Cafeteria Hallway

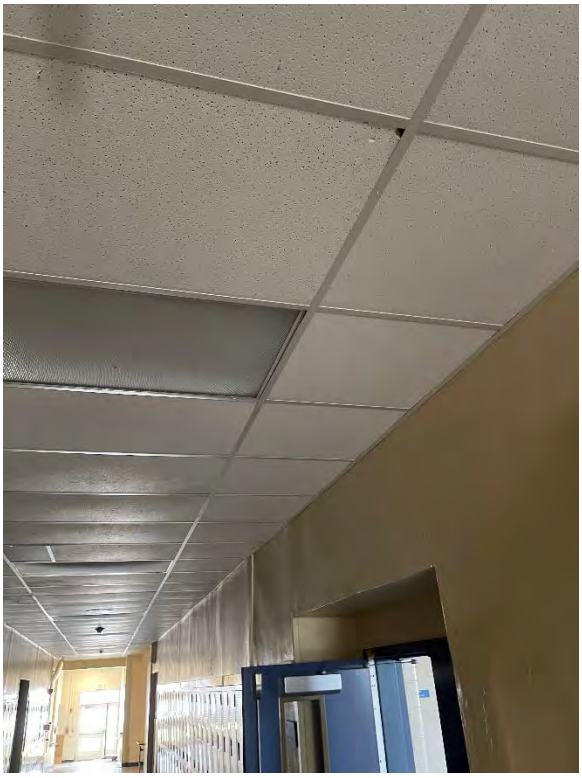

Photo 68. M-137 White 2x4' Pinhole Ceiling Tile– Cafeteria Hallway

Photo 69. M-138 Tan Carpet Mastic – Room 100

Photo 70. M-139 Gray Boiler Insulation – Basement by Street

Photo 71. M-141 Red Boiler Caulk – Basement by Street

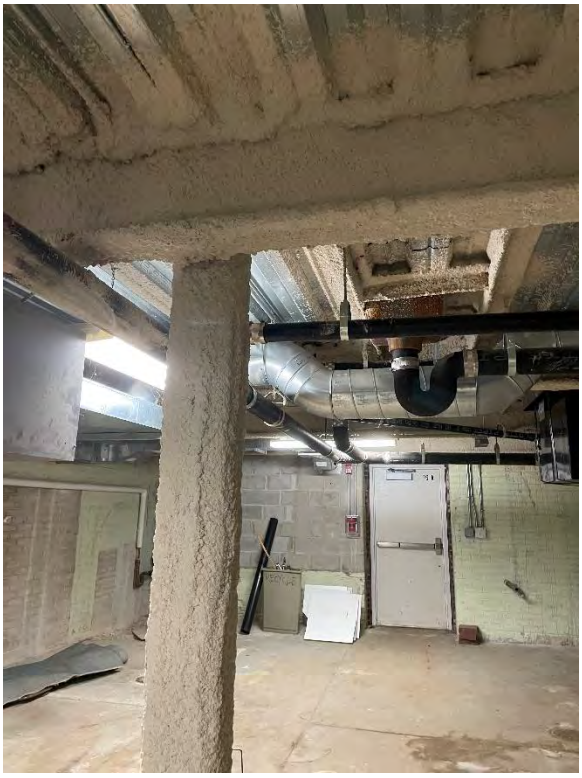

Photo 72. M-142 Gray Spray-On Insulation – Basement by Back Street

Photo 73. M-143 Brown 9x9'' Floor Tile – Basement First Room on Right

Photo 74. M-145 Fire Caulk – Emergency Fire Exit

Photo 75. M-146 Debris from Crawlspace – Crawl Space with Asbestos Hazard Sign

Highlighted Red = Confirmed ACM

Photo 1. M-01 Black Mats – Roof 1 Lower Right

Photo 2. M-02 Silver Roof Liner – Roof 1 Lower Right

Photo 3. M-03 Roof Core – Roof 1 Lower Right

Photo 4. M-03 Roof Core – Roof 1 Middle

Photo 5. M-04 HVAC Skirt – Roof 1 Lower Right

Photo 6. M-05 Tar – Roof 1 Middle Near Drain

Photo 7. M-06 Metal Coating on Pipe– Roof 1 Middle

Photo 8. M-07 Tar – Roof 1 Middle on Ledge

Photo 9. M-08 Copper Flashing and Mastic – Roof 1 Upper Left

Photo 10. M-10 Black Caulk – Roof 1 Lower Left

Photo 11. M-11 White Caulk – Roof 1 Lower Left

Photo 12. M-12 White Caulk – Roof 2 Lower Right

Photo 13. M-13 Black Caulk – Roof 2 Lower Right

Photo 14. M-14 Roof Core – Roof 2 Lower Right

Photo 15. M-14 Roof Core– Roof 2 Upper Right

Photo 16. M-14 Roof Core – Roof 2 Upper Left

Photo 15. M-16 Black Tar Sealant– Roof 2 Upper Left

Photo 16. M-17 Roof Core – Center Front Roof

Appendix C

Photo Log of Suspect and Confirmed LBP

Photo 1. Beige Archway and White Baseboards – Side Area/Stairs by Room 112

Photo 2. Beige Window Sill – Side Area/Stairs by Room 112

Photo 3. Beige Brick Walls – Walls B and C in Room 114

Photo 4. Beige Door Frame – Basement by Front Street

Photo 5. Red Door Frame – Basement by Front Street

Photo 6. White Door – Basement by Front Street

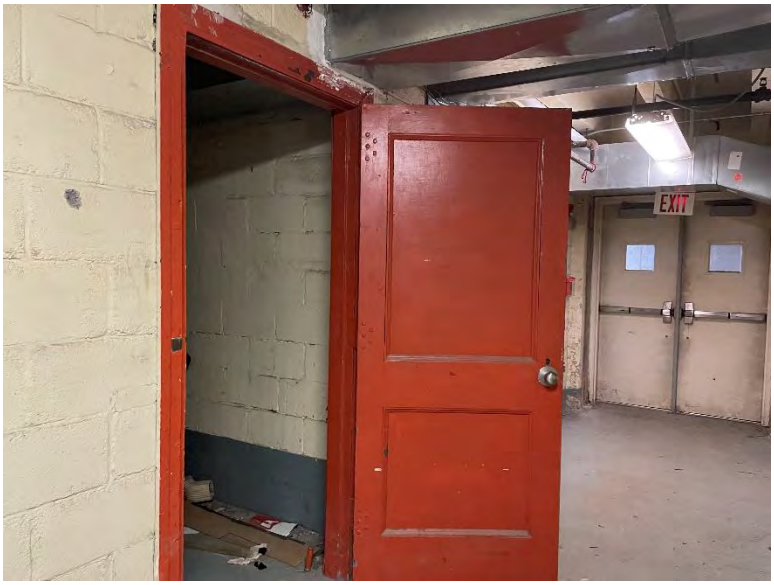

Photo 7. Red Metal Door and Frame – Basement by Front Street

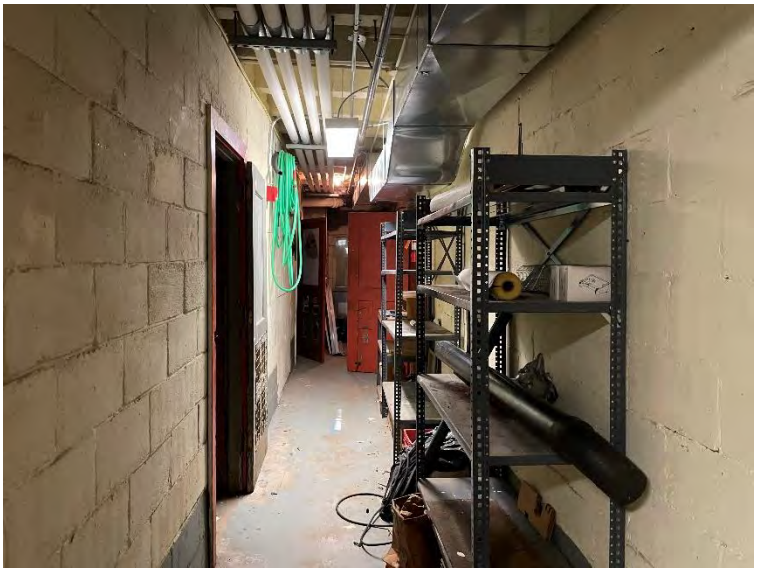

Photo 8. Beige Walls (B, C, D) – Basement by Front Street

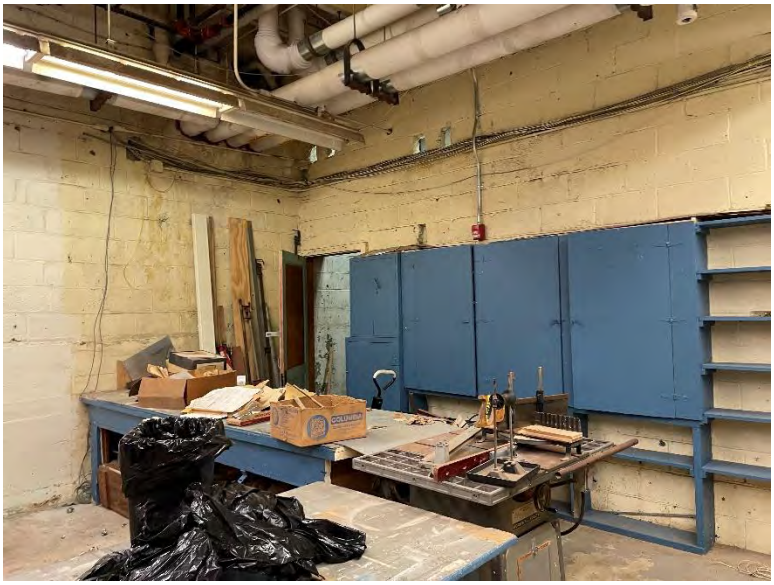

Photo 9. Tan Concrete Walls (A and B) – Room off of Basement by Front Street

Photo 10. White Door Frame – Room off of Basement by Front Street

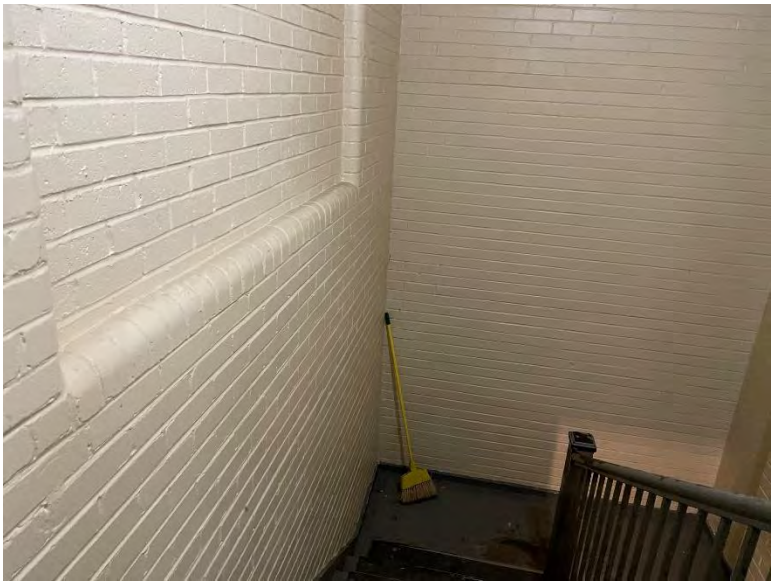

Photo 11. Beige Stairway (B) – Basement by Back Street

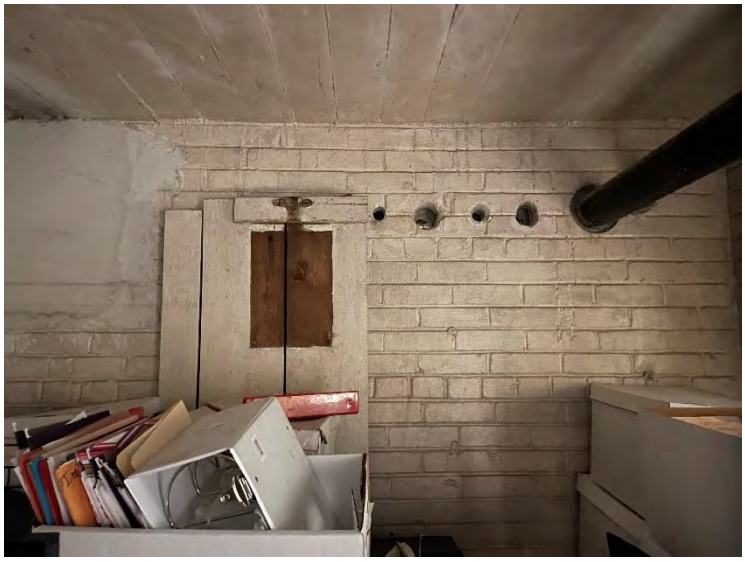

Photo 12. Beige Wall (B) – Room off of Basement by Back Street

Photo 13. Green Wall (B) -- Basement by Back Street

Photo 14. Green Wall Areas – Basement by Back Street

Photo 15. Yellow Lined Paint – Basement by Back Street

Photo 16. White Door Jamb – Basement by Back Street

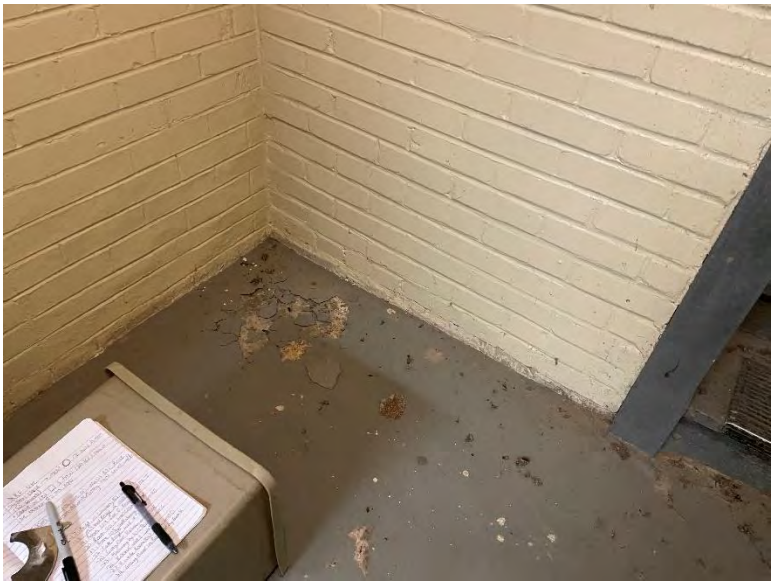

Photo 17. Gray Floor – Basement by Back Street

Photo 18. Differently Painted Area – Basement by Back Street

Photo 19. Gray Railing – Basement by Back Street

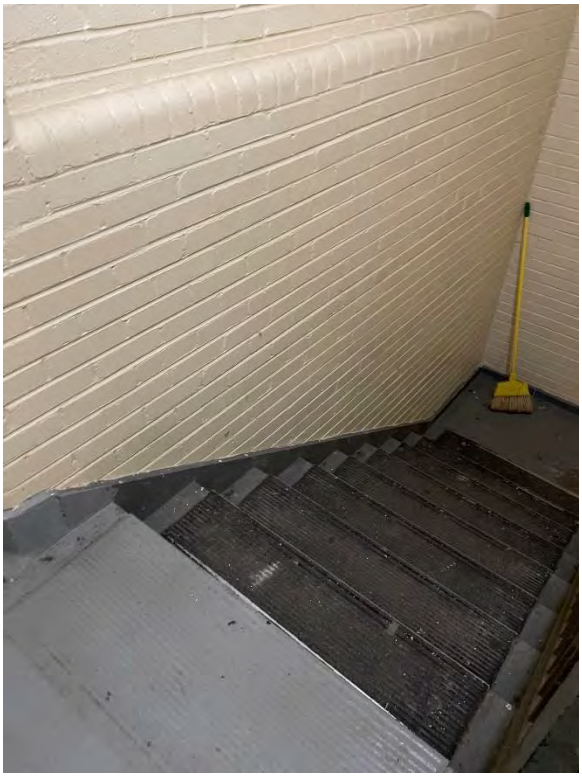

Photo 20. Beige Wall in Stairway – Basement by Back Street

Photo 21. Beige Stairway Walls – Basement by Front Street

Appendix D

Laboratory Reports

OrderID: 042218716

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Chain of Custody

EMSL Order Number *(Lab Use Only)*: 042218716

RECEIVED EMSL CINNAMINSON, NJ 22 AUG -1 PM 4:00

EMSL ANALYTICAL, INC.
200 ROUTE 130 N
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5973

Company : PARS Environmental

EMSL-Bill to: ☒ Same ☐ Different
If Bill to is Different note instructions in Comments**
Third Party Billing requires written authorization from third party

Street: 500 Horizon Drive, Suite 540

City: Robbinsville | **State/Province: NJ** | **Zip/Postal Code: 08691** | **Country: USA**

Report To (Name): Julian Fernandez-Obregon | **Fax #: 609-890-9116**

Telephone #: 609-890-7277 | **Email Address: jfernandez@montrose-env.com**

Project Name/Number: Glassboro Intermediate School

Please Provide Results: ☐ Fax ☒ Email | **Purchase Order: 1200-42** | **U.S. State Samples Taken: NJ**

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☒ 1 Week ☐ 2 Week

**For TEM Air 3 hr through 6 hr, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air
- ☐ NIOSH 7400
- ☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
- ☒ PLM EPA 600/R-93/116 (<1%)
- ☒ PLM EPA NOB (<1%)

Point Count
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)

Point Count w/Gravimetric
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- ☐ NYS 198.1 (friable in NY)
- ☐ NYS 198.6 NOB (non-friable-NY)
- ☐ NIOSH 9002 (<1%)

TEM – Air ☐ **4-4.5hr TAT (AHERA only)**
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312

TEM - Bulk
- ☒ TEM EPA NOB
- ☐ NYS NOB 198.4 (non-friable-NY)
- ☐ Chatfield SOP
- ☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2
- Fibers >10µm ☐ Waste ☐ Drinking
- All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
- ☐ Microvac - ASTM D 5755
- ☐ Wipe - ASTM D6480
- ☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
- ☐ PLM CARB 435 - A (0.25% sensitivity)
- ☐ PLM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - C (0.01% sensitivity)
- ☐ EPA Protocol (Semi-Quantitative)
- ☐ EPA Protocol (Quantitative)

Other:
- ☐

☐ **Check For Positive Stop – Clearly Identify Homogenous Group**

Samplers Name: Marissa Weinstein | **Samplers Signature:** Marissa Weinstein

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
	See Attached		

Client Sample # (s): - **Total # of Samples:** 210

Relinquished (Client): Marissa Weinstein **Date:** 8/1/2022 **Time:**

Received (Lab): David Stepp WT **Date:** 8-1-22 **Time:** 3:50 pm

Comments/Special Instructions:

210 MS

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 2

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-1	Pinhole Ceiling Tile	GIS-1 GIS-2 GIS-3	Third Floor Hallway	1600	D	
M-2	Plaster Joint compound	GIS-4 GIS-5 GIS-6	Third Floor Hallway	10	D	
S-3	White Plaster	GIS-7 GIS-9 GIS-11	Third Floor	5,000	D	
S-4	Brown Plaster	GIS-8 GIS-10 GIS-12	Third Floor	5,000	D	
M-5	Green Baseboard	GIS-13 GIS-15 GIS-17	Third Floor Rooms	750	D	
M-6	Mastic Associated w/ M-5	GIS-14 GIS-16 GIS-18	Third Floor Rooms	750	D	
M-7	Green w/ specks 12"x12" Floor Tile	GIS-19 GIS-21 GIS-23	Third Floor Rooms	1860	D	
M-8	Mastic Associated w/ M-7	GIS-20 GIS-24 GIS-22	Third Floor Rooms	1860	D	
M-9	Gray w/ specks 12"x12" Floor Tile	GIS-25 GIS-27 GIS-29	Third Floor Rooms	5,000	D	
M-10	Mastic Associated w/ M-9	GIS-26 GIS-28 GIS-30	Third Floor Rooms	5,000	D	

RECEIVED EMSL CINNAMINSON, NJ 22 AUG -1 PM 4:00

Signature: Marina West Date Sampled: 7/28/2022 PARS Project #: 1200-42

OrderID: 042218716

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 3

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
m-11	Patch Compound	GIS-31 GIS-32 GIS-33	Third Floor Room 310, North Stairs	5	D	
m-12	Blue Baseboard	GIS-34 GIS-36 GIS-38	Third Floor Rooms 307+308	750	D	
m-13	Mastic Associated w/ m-12	GIS-35 GIS-37 GIS-39	Third Floor Rooms 307+308	750	D	
m-14	Blue 12"x12" Floor w/ specks Tile	GIS-40 GIS-42 GIS-44	Third Floor Rooms 307+308	2,000	D	
m-15	Mastic Associated w/ m-14	GIS-41 GIS-43 GIS-45	Third Floor Rooms 307+308	2,000	D	
m-16	Burgandy Fire Caulk	GIS-46 GIS-47 GIS-48	Third Floor North Stairs	5	D	
m-17	Brown/Tan 9"x9" Floor Tile	GIS-49 GIS-51 GIS-53	Third Floor Hallway	720	D	
m-18	Mastic Associated w/ m-17	GIS-50 GIS-52 GIS-54	Third Floor Hallway	720	D	
m-19	Dark Blue 12"x12" Floor Tile	GIS-55 GIS-57 GIS-59	Third Floor Room 305	796	D	
m-20	Mastic Associated w/ m-19	GIS-56 GIS-58 GIS-60	Third Floor Room 305	796	D	

RECEIVED EMSL CINNAMINSON, NJ 22 AUG -1 PM 4:00

Signature: Marcus West Date Sampled: 7/28/2022 PARS Project #: 1200-42

OrderID: 042218716

042218716

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 4

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
m-21	Drywall	GIS-61 GIS-62 GIS-63	Third Floor Room 305	350	D	
m-22	white w/ Gray Spots 12"x12" Floor Tile	GIS-64 GIS-66 GIS-68	Third Floor Room 305	1580	D	
m-23	mastic Associated w/ m-22	GIS-65 GIS-67 GIS-69	Third Floor Room 305	1580	D	
m-24	Joint Compound	GIS-70 GIS-71 GIS-72	Third Floor	250	D	
m-25	Black Baseboard	GIS-73 GIS-75 GIS-77	Third Floor stairways	30	D	
m-26	mastic Associated w/ m-25	GIS-74 GIS-76 GIS-78	Third Floor stairways	30	D	
m-27	Black Tar	GIS-79 GIS-80 GIS-81	Attic	10	D	
m-28	Black Sheeting	GIS-82 GIS-83 GIS-84	Attic	100	D	
m-29	White caulk	GIS-85 GIS-86 GIS-87	Attic	100	D	
m-30	Gray Baseboard mastic	GIS-88 GIS-89 GIS-90	Third Floor Elevator Area	153	D	

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Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 5

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-31	White Floor tile with Grey specks 12x12 in	GIS-91 GIS-93 GIS-95	2nd floor Faculty Lounge	696 SF	D	
M-32	Mastic Associated with m-31	GIS-92 GIS-94 GIS-96	2nd floor Faculty Lounge	696 SF	D	
M-33	Blue baseboard and Mastic	GIS-97 GIS-98 GIS-99	2nd floor faculty lounge and Room 217	1,221 SF	D	
M-34	Black baseboard and Mastic	GIS-100 GIS-101 GIS-102	2nd floor by stairwell	250 SF	D	
M-35	Carpet Mastic	GIS-103 GIS-104 GIS-105	Room 219 and 215	918 SF	D	
M-36	Drywall Joint compound	GIS-106 GIS-107 GIS-108	Rooms 219, 217, and 212	1562 SF	D	
M-37	Black Glue Tar	GIS-109 GIS-110 GIS-111	Steps under stairwell	153 SF	D	
M-38	Drywall	GIS-112 GIS-113 GIS-114	Rooms 217, 212, and 210	1,719 SF	D	
M-39	Pinhole 2x4 ft ceiling tile	GIS-115 GIS-116 GIS-117	217, hallway outside 217	525 SF	D	
M-40	Dark Blue 12x12 in tile	GIS-118 GIS-120 GIS-122	217 and outside of elevator	678 SF	D	

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Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 6

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-41	Mastic associated with M-40	GIS-119 GIS-121 GIS-123	217 and Outside of elevator	678 SF	D	
S-42	Plaster joint Compound	GIS-124 GIS-125 GIS-126	2nd floor north	515 SF	D	
M-43	Red 12x12 in tile	GIS-127 GIS-129 GIS-131	Rooms 212, 213 and 208	1857 SF	D	
M-44	Mastic associated with M-43	GIS-128 GIS-130 GIS-132	Rooms 212, 213 and 208	1857 SF	D	
M-45	Tan speckled 12x12 in tile	GIS-133 GIS-135 GIS-137	Rooms 212, 213 and 208	1857 SF	D	
M-46	Mastic associated with M-45	GIS-134 GIS-136 GIS-138	Rooms 212, 213 and 208	1857 SF	D	
S-47	Plaster- White	GIS-139 GIS-141 GIS-143	Steps near stairwell and 217	525 SF	D	
S-48	Plaster- Brown	GIS-140 GIS-142 GIS-144	Steps near stairwell and 217	525 SF	D	
M-49	Light Blue 12x12 in tile	GIS-145 GIS-147 GIS-149	Rooms 210, 209/211, and 200	2,359 SF	D	
M-50	Mastic associated with M-49	GIS-146 GIS-148 GIS-150	Rooms 210, 209/211 and 200	2,359 SF	D	

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Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 7

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-51	Red Baseboard and Mastic	GIS-151 GIS-152 GIS-153	Rooms 210, 209/211 200	2,359SF	D	
S-52	Plaster-White	GIS-154 GIS-156 GIS-158	Bathroom, Stairwell across bathroom, end of hall	252SF	D	
S-53	Plaster-Brown	GIS-155 GIS-157 GIS-159	Bathroom, Stairwell across bathroom, end of hall	252SF	D	
M-54	Black counters	GIS-160 GIS-161 GIS-162	Rooms 219, 200 and 201	2,408SF	D	
M-55	Linoleum black traction tread	GIS-163 GIS-165 GIS-167	Hallway South to Stairs and stairs	150 SF	D	
M-56	Mastic associated with M-55	GIS-164 GIS-166 GIS-168	Hallway South to stairs and stairs	150 SF	D	
M-57	Pinhole and Circular Crater 2x4ft white ceiling tile	GIS-169 GIS-170 GIS-171	Room 215	222SF	D	
M-58	Pinhole and Oblong Crater 2x4ft white ceiling tile	GIS-172 GIS-173 GIS-174	Room 215	222SF	D	
M-59	Black sink Under-coating	GIS-175 GIS-176 GIS-177	Room 217	525SF	D	
M-60	Dark Red Baseboard and mastic	GIS-178 GIS-179 GIS-180	Room 200 and 202	2212SF	D	

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Sampling Technician: MW Site Location 9 South Broadway, Cape May Court House Page: 8

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-61	Dark Blue Baseboard and mastic	GIS-181 GIS-182 GIS-183	Room 201 and south hallway	1120SF	D	
M-62	White 12x12 in floor tile with grey specks	GIS-184 GIS-186 GIS-188	Rooms 201, 200 and 202	2212SF	D	
M-63	Mastic associated with m-62	GIS-185 GIS-187 GIS-189	Rooms 201, 200 and 202	2212SF	D	
M-64	Red 12x12 in floor tile	GIS-190 GIS-192 GIS-194	Room 201	1120SF	D	
M-65	Mastic associated with m-64	GIS-191 GIS-193 GIS-195	Room 201	1120SF	D	
M-66	Drywall	GIS-196 GIS-197 GIS-198	Rooms 200, 201 and 202	2212SF	D	
M-67	Drywall joint compound	GIS-199 GIS-200 GIS-201	Rooms 200, 201 and 202	2212SF	D	
M-68	Light blue 12x12 in floor tile	GIS-202 GIS-204 GIS-206	Room 200	1092SF	D	
M-69	Floor leveling associated with M-68	GIS-203 GIS-205 GIS-207	Room 200	1092SF	D	
M-70	Hood Backing	GIS-208 GIS-209 GIS-210	200 Prep Room	347SF	D	

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Attn: Julian Fernandez-Obregon
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Suite 540
Robbinsville, NJ 08691

Phone:	(609) 890-7277
Fax:	(609) 890-9116
Collected:	7/28/2022
Received:	8/01/2022
Analyzed:	8/12/2022

Proj: Glassboro Intermediate School / 9 South Broadway, Cape May Court House

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GIS-1 ***Lab Sample ID:*** **042218716-0001**
Sample Description: Third Floor Hallway/Pinhole Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	85.0%	15.0%	None Detected	

Client Sample ID: GIS-2 ***Lab Sample ID:*** **042218716-0002**
Sample Description: Third Floor Hallway/Pinhole Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-3 ***Lab Sample ID:*** **042218716-0003**
Sample Description: Third Floor Hallway/Pinhole Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-4 ***Lab Sample ID:*** **042218716-0004**
Sample Description: Third Floor Hallway/Plaster Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-5 ***Lab Sample ID:*** **042218716-0005**
Sample Description: Third Floor Hallway/Plaster Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-6 ***Lab Sample ID:*** **042218716-0006**
Sample Description: Third Floor Hallway/Plaster Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-7 ***Lab Sample ID:*** **042218716-0007**
Sample Description: Third Floor/White Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-9 ***Lab Sample ID:*** **042218716-0008**
Sample Description: Third Floor/White Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-11 ***Lab Sample ID:*** **042218716-0009**
Sample Description: Third Floor/White Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-8 ***Lab Sample ID:*** **042218716-0010**
Sample Description: Third Floor/Brown Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GIS-10 ***Lab Sample ID:*** **042218716-0011**
Sample Description: Third Floor/Brown Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GIS-12 ***Lab Sample ID:*** **042218716-0012**
Sample Description: Third Floor/Brown Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GIS-13 ***Lab Sample ID:*** **042218716-0013**
Sample Description: Third Floor Rooms/Green Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-15 ***Lab Sample ID:*** **042218716-0014**
Sample Description: Third Floor Rooms/Green Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-17 ***Lab Sample ID:*** **042218716-0015**
Sample Description: Third Floor Rooms/Green Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Green	0.0%	100%	None Detected	

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Client Sample ID: GIS-14 ***Lab Sample ID:*** **042218716-0016**

Sample Description: Third Floor Rooms/Mastic associated w/M-5

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-16 ***Lab Sample ID:*** **042218716-0017**

Sample Description: Third Floor Rooms/Mastic associated w/M-5

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-18 ***Lab Sample ID:*** **042218716-0018**

Sample Description: Third Floor Rooms/Mastic associated w/M-5

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-19 ***Lab Sample ID:*** **042218716-0019**

Sample Description: Third Floor Rooms/Green w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-21 ***Lab Sample ID:*** **042218716-0020**

Sample Description: Third Floor Rooms/Green w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-23 ***Lab Sample ID:*** **042218716-0021**

Sample Description: Third Floor Rooms/Green w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-20 ***Lab Sample ID:*** **042218716-0022**

Sample Description: Third Floor Rooms/Mastic associated w/M-7

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Black/Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-24 ***Lab Sample ID:*** **042218716-0023**

Sample Description: Third Floor Rooms/Mastic associated w/M-7

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022				Insufficient Material	

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Client Sample ID: GIS-22 ***Lab Sample ID:*** **042218716-0024**

Sample Description: Third Floor Rooms/Mastic associated w/M-7

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black/Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-25 ***Lab Sample ID:*** **042218716-0025**

Sample Description: Third Floor Rooms/Gray w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Gray	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-27 ***Lab Sample ID:*** **042218716-0026**

Sample Description: Third Floor Rooms/Gray w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Gray	0.0%	100%	None Detected	

Client Sample ID: GIS-29 ***Lab Sample ID:*** **042218716-0027**

Sample Description: Third Floor Rooms/Gray w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-26 ***Lab Sample ID:*** **042218716-0028**

Sample Description: Third Floor Rooms/Mastic associated w/M-9

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022				Insufficient Material	

Client Sample ID: GIS-28 ***Lab Sample ID:*** **042218716-0029**

Sample Description: Third Floor Rooms/Mastic associated w/M-9

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-30 ***Lab Sample ID:*** **042218716-0030**

Sample Description: Third Floor Rooms/Mastic associated w/M-9

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White/Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-31-Patch Compound ***Lab Sample ID:*** **042218716-0031**

Sample Description: Third Floor Room 310 North Stairs/Patch Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Tan/White	0.0%	100.0%	None Detected	Result includes a small amount of inseparable attached material

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GIS-31-Base Coat **Lab Sample ID:** **042218716-0031A**
Sample Description: Third Floor Room 310 North Stairs/Base Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-32-Patch Compound **Lab Sample ID:** **042218716-0032**
Sample Description: Third Floor Room 310 North Stairs/Patch Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Tan/White	0.0%	100.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-32-Base Coat **Lab Sample ID:** **042218716-0032A**
Sample Description: Third Floor Room 310 North Stairs/Base Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-33-Patch Compound **Lab Sample ID:** **042218716-0033**
Sample Description: Third Floor Room 310 North Stairs/Patch Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Tan/White	0.0%	100.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-33-Base Coat **Lab Sample ID:** **042218716-0033A**
Sample Description: Third Floor Room 310 North Stairs/Base Coat

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-34 **Lab Sample ID:** **042218716-0034**
Sample Description: Third Floor Rooms 307 and 308/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-36 **Lab Sample ID:** **042218716-0035**
Sample Description: Third Floor Rooms 307 and 308/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-38 **Lab Sample ID:** **042218716-0036**
Sample Description: Third Floor Rooms 307 and 308/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GIS-35 ***Lab Sample ID:*** **042218716-0037**

Sample Description: Third Floor Rooms 307 and 308/Mastic associated w/M-12

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-37 ***Lab Sample ID:*** **042218716-0038**

Sample Description: Third Floor Rooms 307 and 308/Mastic associated w/M-12

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/09/2022				Insufficient Material	

Client Sample ID: GIS-39 ***Lab Sample ID:*** **042218716-0039**

Sample Description: Third Floor Rooms 307 and 308/Mastic associated w/M-12

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-40 ***Lab Sample ID:*** **042218716-0040**

Sample Description: Third Floor Rooms 307 and 308/Blue 12"x12" w/Specks Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-42 ***Lab Sample ID:*** **042218716-0041**

Sample Description: Third Floor Rooms 307 and 308/Blue 12"x12" w/Specks Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-44 ***Lab Sample ID:*** **042218716-0042**

Sample Description: Third Floor Rooms 307 and 308/Blue 12"x12" w/Specks Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-41 ***Lab Sample ID:*** **042218716-0043**

Sample Description: Third Floor Rooms 307 and 308/Mastic associated w/M14

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black/Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-43 ***Lab Sample ID:*** **042218716-0044**

Sample Description: Third Floor Rooms 307 and 308/Mastic associated w/M14

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

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Client Sample ID: GIS-45 ***Lab Sample ID:*** **042218716-0045**

Sample Description: Third Floor Rooms 307 and 308/Mastic associated w/M14

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-46 ***Lab Sample ID:*** **042218716-0046**

Sample Description: Third Floor North Stairs/Burgandy Fire Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-47 ***Lab Sample ID:*** **042218716-0047**

Sample Description: Third Floor North Stairs/Burgandy Fire Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-48 ***Lab Sample ID:*** **042218716-0048**

Sample Description: Third Floor North Stairs/Burgandy Fire Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-49 ***Lab Sample ID:*** **042218716-0049**

Sample Description: Third Floor Hallway/Brown / Tan 9"x9 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Brown/Tan	0.0%	95.0%	**5.0% Chrysotile**	

Client Sample ID: GIS-51 ***Lab Sample ID:*** **042218716-0050**

Sample Description: Third Floor Hallway/Brown / Tan 9"x9 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Brown/Tan	0.0%	94.7%	**5.3% Chrysotile**	

Client Sample ID: GIS-53 ***Lab Sample ID:*** **042218716-0051**

Sample Description: Third Floor Hallway/Brown / Tan 9"x9 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Brown/Tan	0.0%	94.1%	**5.9% Chrysotile**	

Client Sample ID: GIS-50 ***Lab Sample ID:*** **042218716-0052**

Sample Description: Third Floor Hallway/Mastic associated w/M-17

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black/Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black/Yellow	0.0%	100.0%	**<0.1% Chrysotile**	

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Client Sample ID: GIS-52 ***Lab Sample ID:*** **042218716-0053**
Sample Description: Third Floor Hallway/Mastic associated w/M-17

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022				Insufficient Material	

Client Sample ID: GIS-54 ***Lab Sample ID:*** **042218716-0054**
Sample Description: Third Floor Hallway/Mastic associated w/M-17

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022				Insufficient Material	

Client Sample ID: GIS-55 ***Lab Sample ID:*** **042218716-0055**
Sample Description: Third Floor 305/Dark Blue 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	**<0.1% Chrysotile**	

Client Sample ID: GIS-57 ***Lab Sample ID:*** **042218716-0056**
Sample Description: Third Floor 305/Dark Blue 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-59 ***Lab Sample ID:*** **042218716-0057**
Sample Description: Third Floor 305/Dark Blue 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-56 ***Lab Sample ID:*** **042218716-0058**
Sample Description: Third Floor 305/Mastic associated w/M-19

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-58 ***Lab Sample ID:*** **042218716-0059**
Sample Description: Third Floor 305/Mastic associated w/M-19

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-60 ***Lab Sample ID:*** **042218716-0060**
Sample Description: Third Floor 305/Mastic associated w/M-19

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

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Client Sample ID: GIS-61 ***Lab Sample ID:*** **042218716-0061**
Sample Description: Third Floor 305/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-62 ***Lab Sample ID:*** **042218716-0062**
Sample Description: Third Floor 305/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-63 ***Lab Sample ID:*** **042218716-0063**
Sample Description: Third Floor 305/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-64 ***Lab Sample ID:*** **042218716-0064**
Sample Description: Third Floor 305/White w/ Gray Spots 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-66 ***Lab Sample ID:*** **042218716-0065**
Sample Description: Third Floor 305/White w/ Gray Spots 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/White	0.0%	100%	None Detected	

Client Sample ID: GIS-68 ***Lab Sample ID:*** **042218716-0066**
Sample Description: Third Floor 305/White w/ Gray Spots 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/White	0.0%	100%	None Detected	

Client Sample ID: GIS-65 ***Lab Sample ID:*** **042218716-0067**
Sample Description: Third Floor 305/Mastic associated w/M-22

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-67 ***Lab Sample ID:*** **042218716-0068**
Sample Description: Third Floor 305/Mastic associated w/M-22

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

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Client Sample ID: GIS-69 ***Lab Sample ID:*** **042218716-0069**

Sample Description: Third Floor 305/Mastic associated w/M-22

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-70 ***Lab Sample ID:*** **042218716-0070**

Sample Description: Third Floor/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-71 ***Lab Sample ID:*** **042218716-0071**

Sample Description: Third Floor/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-72 ***Lab Sample ID:*** **042218716-0072**

Sample Description: Third Floor/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-73 ***Lab Sample ID:*** **042218716-0073**

Sample Description: Third Floor Stairways/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-75 ***Lab Sample ID:*** **042218716-0074**

Sample Description: Third Floor Stairways/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-77 ***Lab Sample ID:*** **042218716-0075**

Sample Description: Third Floor Stairways/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-74 ***Lab Sample ID:*** **042218716-0076**

Sample Description: Third Floor Stairways/Mastic associated w/M25

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-76 ***Lab Sample ID:*** **042218716-0077**
Sample Description: Third Floor Stairways/Mastic associated w/M25

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-78 ***Lab Sample ID:*** **042218716-0078**
Sample Description: Third Floor Stairways/Mastic associated w/M25

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-79 ***Lab Sample ID:*** **042218716-0079**
Sample Description: Attic/Black Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-80 ***Lab Sample ID:*** **042218716-0080**
Sample Description: Attic/Black Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-81 ***Lab Sample ID:*** **042218716-0081**
Sample Description: Attic/Black Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-82 ***Lab Sample ID:*** **042218716-0082**
Sample Description: Attic/Black Sheeting

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	1.2%	98.8%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-83 ***Lab Sample ID:*** **042218716-0083**
Sample Description: Attic/Black Sheeting

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.65%	99.0%	**0.26% Chrysotile**	

Client Sample ID: GIS-84 ***Lab Sample ID:*** **042218716-0084**
Sample Description: Attic/Black Sheeting

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	99.7%	**0.26% Chrysotile**	

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Client Sample ID: GIS-85 ***Lab Sample ID:*** **042218716-0085**
Sample Description: Attic/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-86 ***Lab Sample ID:*** **042218716-0086**
Sample Description: Attic/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-87 ***Lab Sample ID:*** **042218716-0087**
Sample Description: Attic/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-88 ***Lab Sample ID:*** **042218716-0088**
Sample Description: Third Floor Elevator Area/Gray Baseboard Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-89 ***Lab Sample ID:*** **042218716-0089**
Sample Description: Third Floor Elevator Area/Gray Baseboard Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-90 ***Lab Sample ID:*** **042218716-0090**
Sample Description: Third Floor Elevator Area/Gray Baseboard Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-91 ***Lab Sample ID:*** **042218716-0091**
Sample Description: 2nd Floor Faculty Lounge/White Floor Tile with Grey Specks 12x12

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-93 ***Lab Sample ID:*** **042218716-0092**
Sample Description: 2nd Floor Faculty Lounge/White Floor Tile with Grey Specks 12x12

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/White	0.0%	100%	None Detected	

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Client Sample ID: GIS-95 ***Lab Sample ID:*** **042218716-0093**

Sample Description: 2nd Floor Faculty Lounge/White Floor Tile with Grey Specks 12x12

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/White	0.0%	100%	None Detected	

Client Sample ID: GIS-92 ***Lab Sample ID:*** **042218716-0094**

Sample Description: 2nd Floor Faculty Lounge/Mastic associated w/M-31

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-94 ***Lab Sample ID:*** **042218716-0095**

Sample Description: 2nd Floor Faculty Lounge/Mastic associated w/M-31

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-96 ***Lab Sample ID:*** **042218716-0096**

Sample Description: 2nd Floor Faculty Lounge/Mastic associated w/M-31

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-97-Baseboard ***Lab Sample ID:*** **042218716-0097**

Sample Description: 2nd Floor Faculty Lounge and Room 217/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-97-Mastic ***Lab Sample ID:*** **042218716-0097A**

Sample Description: 2nd Floor Faculty Lounge and Room 217/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-98-Baseboard ***Lab Sample ID:*** **042218716-0098**

Sample Description: 2nd Floor Faculty Lounge and Room 217/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-98-Mastic ***Lab Sample ID:*** **042218716-0098A**

Sample Description: 2nd Floor Faculty Lounge and Room 217/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

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Client Sample ID: GIS-99-Baseboard ***Lab Sample ID:*** **042218716-0099**

Sample Description: 2nd Floor Faculty Lounge and Room 217/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-99-Mastic ***Lab Sample ID:*** **042218716-0099A**

Sample Description: 2nd Floor Faculty Lounge and Room 217/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-100-Baseboard ***Lab Sample ID:*** **042218716-0100**

Sample Description: 2nd Floor by Stairwell/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-100-Mastic ***Lab Sample ID:*** **042218716-0100A**

Sample Description: 2nd Floor by Stairwell/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-101-Baseboard ***Lab Sample ID:*** **042218716-0101**

Sample Description: 2nd Floor by Stairwell/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-101A-Mastic ***Lab Sample ID:*** **042218716-0101A**

Sample Description: 2nd Floor by Stairwell/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-102-Baseboard ***Lab Sample ID:*** **042218716-0102**

Sample Description: 2nd Floor by Stairwell/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-102-Mastic ***Lab Sample ID:*** **042218716-0102A**

Sample Description: 2nd Floor by Stairwell/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

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Client Sample ID: GIS-103 ***Lab Sample ID:*** **042218716-0103**
Sample Description: Room 219 and 215/Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-104 ***Lab Sample ID:*** **042218716-0104**
Sample Description: Room 219 and 215/Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-105 ***Lab Sample ID:*** **042218716-0105**
Sample Description: Room 219 and 215/Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-106 ***Lab Sample ID:*** **042218716-0106**
Sample Description: Room 219,217, and 212/Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-107 ***Lab Sample ID:*** **042218716-0107**
Sample Description: Room 219,217, and 212/Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-108 ***Lab Sample ID:*** **042218716-0108**
Sample Description: Room 219,217, and 212/Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-109 ***Lab Sample ID:*** **042218716-0109**
Sample Description: Steps Under Stairwell/Black Glue Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	97.4%	**2.6% Chrysotile**	

Client Sample ID: GIS-110 ***Lab Sample ID:*** **042218716-0110**
Sample Description: Steps Under Stairwell/Black Glue Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	97.7%	**2.3% Chrysotile**	

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Client Sample ID: GIS-111 ***Lab Sample ID:*** **042218716-0111**

Sample Description: Steps Under Stairwell/Black Glue Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	97.5%	**2.5% Chrysotile**	

Client Sample ID: GIS-112 ***Lab Sample ID:*** **042218716-0112**

Sample Description: Room 217. 212 and 210/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-113 ***Lab Sample ID:*** **042218716-0113**

Sample Description: Room 217. 212 and 210/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-114 ***Lab Sample ID:*** **042218716-0114**

Sample Description: Room 217. 212 and 210/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown/White	18.0%	82.0%	None Detected	

Client Sample ID: GIS-115 ***Lab Sample ID:*** **042218716-0115**

Sample Description: 217 Hallway Outside 217/Pinhole 2x4 Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-116 ***Lab Sample ID:*** **042218716-0116**

Sample Description: 217 Hallway Outside 217/Pinhole 2x4 Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	85.0%	15.0%	None Detected	

Client Sample ID: GIS-117 ***Lab Sample ID:*** **042218716-0117**

Sample Description: 217 Hallway Outside 217/Pinhole 2x4 Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-118 ***Lab Sample ID:*** **042218716-0118**

Sample Description: 217 and Outside of Elevator/Dark Blue 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-120 ***Lab Sample ID:*** **042218716-0119**

Sample Description: 217 and Outside of Elevator/Dark Blue 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-122 ***Lab Sample ID:*** **042218716-0120**

Sample Description: 217 and Outside of Elevator/Dark Blue 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-119 ***Lab Sample ID:*** **042218716-0121**

Sample Description: 217 and Outside of Elevator/Mastic associated w/M-40

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-121 ***Lab Sample ID:*** **042218716-0122**

Sample Description: 217 and Outside of Elevator/Mastic associated w/M-40

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-123 ***Lab Sample ID:*** **042218716-0123**

Sample Description: 217 and Outside of Elevator/Mastic associated w/M-40

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-124-Skim Coat ***Lab Sample ID:*** **042218716-0124**

Sample Description: 2nd Floor North/Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-124-Base Coat ***Lab Sample ID:*** **042218716-0124A**

Sample Description: 2nd Floor North/Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-124-Joint Compound ***Lab Sample ID:*** **042218716-0124B**

Sample Description: 2nd Floor North/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-125-Skim Coat ***Lab Sample ID:*** **042218716-0125**
Sample Description: 2nd Floor North/Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-125-Base Coat ***Lab Sample ID:*** **042218716-0125A**
Sample Description: 2nd Floor North/Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-125-Joint Compound ***Lab Sample ID:*** **042218716-0125B**
Sample Description: 2nd Floor North/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-126-Skim Coat ***Lab Sample ID:*** **042218716-0126**
Sample Description: 2nd Floor North/Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-126-Base Coat ***Lab Sample ID:*** **042218716-0126A**
Sample Description: 2nd Floor North/Plaster

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-126-Joint Compound ***Lab Sample ID:*** **042218716-0126B**
Sample Description: 2nd Floor North/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-127 ***Lab Sample ID:*** **042218716-0127**
Sample Description: Rooms 212, 213 and 208/Red 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-129 ***Lab Sample ID:*** **042218716-0128**
Sample Description: Rooms 212, 213 and 208/Red 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

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Client Sample ID: GIS-131 ***Lab Sample ID:*** **042218716-0129**

Sample Description: Rooms 212, 213 and 208/Red 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-128 ***Lab Sample ID:*** **042218716-0130**

Sample Description: Rooms 212, 213 and 208/Mastic associated w/M-43

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-130 ***Lab Sample ID:*** **042218716-0131**

Sample Description: Rooms 212, 213 and 208/Mastic associated w/M-43

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-132 ***Lab Sample ID:*** **042218716-0132**

Sample Description: Rooms 212, 213 and 208/Mastic associated w/M-43

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black/Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-133 ***Lab Sample ID:*** **042218716-0133**

Sample Description: Rooms 212, 213 and 208/Tan Speckled 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Tan	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Tan	0.0%	100.0%	None Detected	

Client Sample ID: GIS-135 ***Lab Sample ID:*** **042218716-0134**

Sample Description: Rooms 212, 213 and 208/Tan Speckled 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-137 ***Lab Sample ID:*** **042218716-0135**

Sample Description: Rooms 212, 213 and 208/Tan Speckled 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-134 ***Lab Sample ID:*** **042218716-0136**

Sample Description: Rooms 212, 213 and 208/Mastic associated w/M45

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black/Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black/Yellow	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-136 ***Lab Sample ID:*** **042218716-0137**

Sample Description: Rooms 212, 213 and 208/Mastic associated w/M45

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-138 ***Lab Sample ID:*** **042218716-0138**

Sample Description: Rooms 212, 213 and 208/Mastic associated w/M45

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-139 ***Lab Sample ID:*** **042218716-0139**

Sample Description: Steps Near Stairs and 217/Plaster -White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Tan/White	0.0%	100.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-141 ***Lab Sample ID:*** **042218716-0140**

Sample Description: Steps Near Stairs and 217/Plaster -White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-143 ***Lab Sample ID:*** **042218716-0141**

Sample Description: Steps Near Stairs and 217/Plaster -White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-140 ***Lab Sample ID:*** **042218716-0142**

Sample Description: Steps Hear Stairwell and 217/Plaster Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GIS-142 ***Lab Sample ID:*** **042218716-0143**

Sample Description: Steps Hear Stairwell and 217/Plaster Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GIS-144 ***Lab Sample ID:*** **042218716-0144**

Sample Description: Steps Hear Stairwell and 217/Plaster Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-145 ***Lab Sample ID:*** **042218716-0145**

Sample Description: Rooms 210 209/211 and 200/Light Blue 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-147 ***Lab Sample ID:*** **042218716-0146**

Sample Description: Rooms 210 209/211 and 200/Light Blue 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-149 ***Lab Sample ID:*** **042218716-0147**

Sample Description: Rooms 210 209/211 and 200/Light Blue 12x12 Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-146 ***Lab Sample ID:*** **042218716-0148**

Sample Description: Rooms 210, 209/211 and 200/Mastic assocaited w/M-49

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black/Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-148 ***Lab Sample ID:*** **042218716-0149**

Sample Description: Rooms 210, 209/211 and 200/Mastic assocaited w/M-49

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-150 ***Lab Sample ID:*** **042218716-0150**

Sample Description: Rooms 210, 209/211 and 200/Mastic assocaited w/M-49

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-151-Baseboard ***Lab Sample ID:*** **042218716-0151**

Sample Description: Rooms 210, 209/211 and 200/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Red	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-151-Mastic ***Lab Sample ID:*** **042218716-0151A**

Sample Description: Rooms 210, 209/211 and 200/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow/Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Yellow/Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-152-Baseboard ***Lab Sample ID:*** **042218716-0152**

Sample Description: Rooms 210, 209/211 and 200/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-152-Mastic ***Lab Sample ID:*** **042218716-0152A**

Sample Description: Rooms 210, 209/211 and 200/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow/Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-153-Baseboard ***Lab Sample ID:*** **042218716-0153**

Sample Description: Rooms 210, 209/211 and 200/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-153-Mastic ***Lab Sample ID:*** **042218716-0153A**

Sample Description: Rooms 210, 209/211 and 200/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow/Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-154 ***Lab Sample ID:*** **042218716-0154**

Sample Description: Bathroom Stairwell Across Bathroom End of Hall/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-156 ***Lab Sample ID:*** **042218716-0155**

Sample Description: Bathroom Stairwell Across Bathroom End of Hall/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-158 ***Lab Sample ID:*** **042218716-0156**

Sample Description: Bathroom Stairwell Across Bathroom End of Hall/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-155 ***Lab Sample ID:*** **042218716-0157**

Sample Description: Bathroom Stairwell Across Bathroom End of Hall/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown/Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-157 ***Lab Sample ID:*** **042218716-0158**

Sample Description: Bathroom Stairwell Across Bathroom End of Hall/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown/Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-159 ***Lab Sample ID:*** **042218716-0159**

Sample Description: Bathroom Stairwell Across Bathroom End of Hall/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown/Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-160 ***Lab Sample ID:*** **042218716-0160**

Sample Description: Rooms 219, 200 and 201/Black Counters

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-161 ***Lab Sample ID:*** **042218716-0161**

Sample Description: Rooms 219, 200 and 201/Black Counters

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-162 ***Lab Sample ID:*** **042218716-0162**

Sample Description: Rooms 219, 200 and 201/Black Counters

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-163 ***Lab Sample ID:*** **042218716-0163**

Sample Description: Hallway South to Stairs/Linoleum Black Traction Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-165 ***Lab Sample ID:*** **042218716-0164**

Sample Description: Hallway South to Stairs/Linoleum Black Traction Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

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Client Sample ID: GIS-167 ***Lab Sample ID:*** **042218716-0165**

Sample Description: Hallway South to Stairs/Linoleum Black Traction Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-164 ***Lab Sample ID:*** **042218716-0166**

Sample Description: Hallway South to Stairs/Mastic associated w/M-55

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-166 ***Lab Sample ID:*** **042218716-0167**

Sample Description: Hallway South to Stairs/Mastic associated w/M-55

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-168 ***Lab Sample ID:*** **042218716-0168**

Sample Description: Hallway South to Stairs/Mastic associated w/M-55

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-169 ***Lab Sample ID:*** **042218716-0169**

Sample Description: Room 215/Pinhole and Circular Crater 2x4 White Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	85.0%	15.0%	None Detected	

Client Sample ID: GIS-170 ***Lab Sample ID:*** **042218716-0170**

Sample Description: Room 215/Pinhole and Circular Crater 2x4 White Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-171 ***Lab Sample ID:*** **042218716-0171**

Sample Description: Room 215/Pinhole and Circular Crater 2x4 White Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-172 ***Lab Sample ID:*** **042218716-0172**

Sample Description: Room 215/Pinhole and Oblong Crater 2x4 White Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	80.0%	20.0%	None Detected	

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Client Sample ID: GIS-173 ***Lab Sample ID:*** **042218716-0173**
Sample Description: Room 215/Pinhole and Oblong Crater 2x4 White Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-174 ***Lab Sample ID:*** **042218716-0174**
Sample Description: Room 215/Pinhole and Oblong Crater 2x4 White Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-175 ***Lab Sample ID:*** **042218716-0175**
Sample Description: Room 217/Black Sink Under Coating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-176 ***Lab Sample ID:*** **042218716-0176**
Sample Description: Room 217/Black Sink Under Coating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-177 ***Lab Sample ID:*** **042218716-0177**
Sample Description: Room 217/Black Sink Under Coating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-178-Baseboard ***Lab Sample ID:*** **042218716-0178**
Sample Description: Room 200 and 202/Dark Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-178-Mastic ***Lab Sample ID:*** **042218716-0178A**
Sample Description: Room 200 and 202/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-179-Baseboard ***Lab Sample ID:*** **042218716-0179**
Sample Description: Room 200 and 202/Dark Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

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Client Sample ID: GIS-179-Mastic **Lab Sample ID:** **042218716-0179A**

Sample Description: Room 200 and 202/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-180-Baseboard **Lab Sample ID:** **042218716-0180**

Sample Description: Room 200 and 202/Dark Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-180-Mastic **Lab Sample ID:** **042218716-0180A**

Sample Description: Room 200 and 202/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-181-Baseboard **Lab Sample ID:** **042218716-0181**

Sample Description: Room 201 and South Hallway/Dark Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-181-Mastic **Lab Sample ID:** **042218716-0181A**

Sample Description: Room 201 and South Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-182-Baseboard **Lab Sample ID:** **042218716-0182**

Sample Description: Room 201 and South Hallway/Dark Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-182-Mastic **Lab Sample ID:** **042218716-0182A**

Sample Description: Room 201 and South Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-183-Baseboard **Lab Sample ID:** **042218716-0183**

Sample Description: Room 201 and South Hallway/Dark Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

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Client Sample ID: GIS-183-Mastic ***Lab Sample ID:*** **042218716-0183A**

Sample Description: Room 201 and South Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-184 ***Lab Sample ID:*** **042218716-0184**

Sample Description: Room 201, 200 and 202/White 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-186 ***Lab Sample ID:*** **042218716-0185**

Sample Description: Room 201, 200 and 202/White 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-188 ***Lab Sample ID:*** **042218716-0186**

Sample Description: Room 201, 200 and 202/White 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-185 ***Lab Sample ID:*** **042218716-0187**

Sample Description: Room 201, 200 and 202/Mastic assocaited w/M-62

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-187 ***Lab Sample ID:*** **042218716-0188**

Sample Description: Room 201, 200 and 202/Mastic assocaited w/M-62

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-189 ***Lab Sample ID:*** **042218716-0189**

Sample Description: Room 201, 200 and 202/Mastic assocaited w/M-62

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022				Insufficient Material	

Client Sample ID: GIS-190 ***Lab Sample ID:*** **042218716-0190**

Sample Description: Room 201/Red 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Red	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-192 ***Lab Sample ID:*** **042218716-0191**
Sample Description: Room 201/Red 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-194 ***Lab Sample ID:*** **042218716-0192**
Sample Description: Room 201/Red 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-191 ***Lab Sample ID:*** **042218716-0193**
Sample Description: Room 201/Mastic associated w/M-64

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-193 ***Lab Sample ID:*** **042218716-0194**
Sample Description: Room 201/Mastic associated w/M-64

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-195 ***Lab Sample ID:*** **042218716-0195**
Sample Description: Room 201/Mastic associated w/M-64

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Yellow	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-196 ***Lab Sample ID:*** **042218716-0196**
Sample Description: Room 201, 200 and 202/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown/White	17.0%	83.0%	None Detected	

Client Sample ID: GIS-197 ***Lab Sample ID:*** **042218716-0197**
Sample Description: Room 201, 200 and 202/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	Brown/White	17.0%	83.0%	None Detected	

Client Sample ID: GIS-198 ***Lab Sample ID:*** **042218716-0198**
Sample Description: Room 201, 200 and 202/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	Brown/White	15.0%	85.0%	None Detected	

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Client Sample ID: GIS-199 ***Lab Sample ID:*** **042218716-0199**
Sample Description: Room 201, 200 and 202/Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-200 ***Lab Sample ID:*** **042218716-0200**
Sample Description: Room 201, 200 and 202/Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/09/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-201 ***Lab Sample ID:*** **042218716-0201**
Sample Description: Room 201, 200 and 202/Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/10/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-202 ***Lab Sample ID:*** **042218716-0202**
Sample Description: Room 200/Light Blue 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-204 ***Lab Sample ID:*** **042218716-0203**
Sample Description: Room 200/Light Blue 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-206 ***Lab Sample ID:*** **042218716-0204**
Sample Description: Room 200/Light Blue 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-203 ***Lab Sample ID:*** **042218716-0205**
Sample Description: Room 200/Floor Leveling associated with M-68

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Gray/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-205 ***Lab Sample ID:*** **042218716-0206**
Sample Description: Room 200/Floor Leveling associated with M-68

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/Yellow	0.0%	100%	None Detected	

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Client Sample ID: GIS-207 ***Lab Sample ID:*** **042218716-0207**

Sample Description: Room 200/Floor Leveling associated with M-68

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Gray/Yellow	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-208 ***Lab Sample ID:*** **042218716-0208**

Sample Description: 200 Prep Room/Hood Backing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Brown/White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/12/2022	Brown/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-209 ***Lab Sample ID:*** **042218716-0209**

Sample Description: 200 Prep Room/Hood Backing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Brown/White	0.0%	100%	None Detected	

Client Sample ID: GIS-210 ***Lab Sample ID:*** **042218716-0210**

Sample Description: 200 Prep Room/Hood Backing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2022	Brown/White	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Analyst(s):

Laura Kantor	PLM (36) PLM Grav. Reduction (13)
Michelle Quach	PLM (28) PLM Grav. Reduction (68)
Rachel Irwin	TEM Grav. Reduction (37)
Sarah Kleinbrahm	PLM (5) PLM Grav. Reduction (78)
Seri Smith	TEM Grav. Reduction (16)

Reviewed and approved by:

Samantha Rundstrom, Laboratory Manager
or Other Approved Signatory

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Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NVLAP Lab Code 101048-0, AIHA-LAP, LLC-IHLAP Lab 100194, NJ DEP 03036, PA ID# 68-00367, LA #04127

Initial report from: 08/12/202214:24:18

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EMSL Order ID:	042219669
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	

Attn: Julian Fernandez-Obregon
PARS Environmental
500 Horizon Drive
Suite 540
Robbinsville, NJ 08691

Proj: Glassboro Intermediate School

Phone:	(609) 890-7277
Fax:	(609) 890-9116
Collected:	7/29/2022
Received:	8/09/2022
Analyzed:	8/21/2022

Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-211-Stair Tread **Lab Sample ID:** **042219669-0001**
Sample Description: South Stairs/Dark Blue Stair Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-211-Mastic **Lab Sample ID:** **042219669-0001A**
Sample Description: South Stairs/Dark Blue Stair Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-212-Stair Tread **Lab Sample ID:** **042219669-0002**
Sample Description: South Stairs/Dark Blue Stair Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-212-Mastic **Lab Sample ID:** **042219669-0002A**
Sample Description: South Stairs/Dark Blue Stair Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-213-Stair Tread **Lab Sample ID:** **042219669-0003**
Sample Description: South Stairs/Dark Blue Stair Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-213-Mastic **Lab Sample ID:** **042219669-0003A**
Sample Description: South Stairs/Dark Blue Stair Tread

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-214 **Lab Sample ID:** **042219669-0004**
Sample Description: 1st Level by Room 114/Dark Blue Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-216 ***Lab Sample ID:*** **042219669-0005**

Sample Description: 1st Level by Room 114/Dark Blue Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-218 ***Lab Sample ID:*** **042219669-0006**

Sample Description: 1st Level by Room 114/Dark Blue Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-215 ***Lab Sample ID:*** **042219669-0007**

Sample Description: 1st Level by Room 114/Mastic associated w/M-72

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-217 ***Lab Sample ID:*** **042219669-0008**

Sample Description: 1st Level by Room 114/Mastic associated w/M-72

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022				Insufficient Material	

Client Sample ID: GIS-219 ***Lab Sample ID:*** **042219669-0009**

Sample Description: 1st Level by Room 114/Mastic associated w/M-72

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-220 ***Lab Sample ID:*** **042219669-0010**

Sample Description: 1st Level by Room 114/White w/Gray Specks 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Gray/White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-222 ***Lab Sample ID:*** **042219669-0011**

Sample Description: 1st Level by Room 114/White w/Gray Specks 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Gray/White	0.0%	100%	None Detected	

Client Sample ID: GIS-224 ***Lab Sample ID:*** **042219669-0012**

Sample Description: 1st Level by Room 114/White w/Gray Specks 12x12 Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Gray/White	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-221 ***Lab Sample ID:*** **042219669-0013**

Sample Description: 1st Level by Room 114/Mastic assocaited w/ M-74

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-223 ***Lab Sample ID:*** **042219669-0014**

Sample Description: 1st Level by Room 114/Mastic assocaited w/ M-74

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-225 ***Lab Sample ID:*** **042219669-0015**

Sample Description: 1st Level by Room 114/Mastic assocaited w/ M-74

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-226-Baseboard ***Lab Sample ID:*** **042219669-0016**

Sample Description: Room 114/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-226-Mastic ***Lab Sample ID:*** **042219669-0016A**

Sample Description: Room 114/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-227-Baseboard ***Lab Sample ID:*** **042219669-0017**

Sample Description: Room 114/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-227-Mastic ***Lab Sample ID:*** **042219669-0017A**

Sample Description: Room 114/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-228-Baseboard ***Lab Sample ID:*** **042219669-0018**

Sample Description: Room 114/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Red	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-228-Mastic ***Lab Sample ID:*** **042219669-0018A**

Sample Description: Room 114/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-229-Baseboard ***Lab Sample ID:*** **042219669-0019**

Sample Description: Hallway Outside Library, Library/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-229-Mastic ***Lab Sample ID:*** **042219669-0019A**

Sample Description: Hallway Outside Library, Library/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-230-Baseboard ***Lab Sample ID:*** **042219669-0020**

Sample Description: Hallway Outside Library, Library/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-230-Mastic ***Lab Sample ID:*** **042219669-0020A**

Sample Description: Hallway Outside Library, Library/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-231-Baseboard ***Lab Sample ID:*** **042219669-0021**

Sample Description: Hallway Outside Library, Library/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-231-Mastic ***Lab Sample ID:*** **042219669-0021A**

Sample Description: Hallway Outside Library, Library/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-232 ***Lab Sample ID:*** **042219669-0022**

Sample Description: Library and Room 114/Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-233 ***Lab Sample ID:*** **042219669-0023**

Sample Description: Library and Room 114/Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-234 ***Lab Sample ID:*** **042219669-0024**

Sample Description: Library and Room 114/Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-235 ***Lab Sample ID:*** **042219669-0025**

Sample Description: Library, Hallway Outside Library, Closet Across 114/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-237 ***Lab Sample ID:*** **042219669-0026**

Sample Description: Library, Hallway Outside Library, Closet Across 114/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-239 ***Lab Sample ID:*** **042219669-0027**

Sample Description: Library, Hallway Outside Library, Closet Across 114/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-236 ***Lab Sample ID:*** **042219669-0028**

Sample Description: Library, Hallway Outside Library, Closet Across 114/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/Gray	5.0%	95.0%	None Detected	

Client Sample ID: GIS-238 ***Lab Sample ID:*** **042219669-0029**

Sample Description: Library, Hallway Outside Library, Closet Across 114/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/Gray	0.0%	100.0%	None Detected	

Client Sample ID: GIS-240 ***Lab Sample ID:*** **042219669-0030**

Sample Description: Library, Hallway Outside Library, Closet Across 114/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-241 ***Lab Sample ID:*** **042219669-0031**

Sample Description: Inside Storage Near 116, Room 116 and 114/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: GIS-242 ***Lab Sample ID:*** **042219669-0032**

Sample Description: Inside Storage Near 116, Room 116 and 114/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: GIS-243 ***Lab Sample ID:*** **042219669-0033**

Sample Description: Inside Storage Near 116, Room 116 and 114/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: GIS-244 ***Lab Sample ID:*** **042219669-0034**

Sample Description: Hallway Outside Library/Pinhole White 2'x4' Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-245 ***Lab Sample ID:*** **042219669-0035**

Sample Description: Hallway Outside Library/Pinhole White 2'x4' Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-246 ***Lab Sample ID:*** **042219669-0036**

Sample Description: Hallway Outside Library/Pinhole White 2'x4' Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray/White	90.0%	10.0%	None Detected	

Client Sample ID: GIS-247 ***Lab Sample ID:*** **042219669-0037**

Sample Description: Inside Storage Near 116, Hall Outisde Storage, Outside 114/Pinhole with Small Circular Crater White 2'x4' Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Gray/White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-248 ***Lab Sample ID:*** **042219669-0038**

Sample Description: Inside Storage Near 116, Hall Outisde Storage, Outside 114/Pinhole with Small Circular Crater White 2'x4' Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Gray/White	80.0%	20.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-249 ***Lab Sample ID:*** **042219669-0039**

Sample Description: Inside Storage Near 116, Hall Outisde Storage, Outside 114/Pinhole with Small Circular Crater White 2'x4' Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray/White	90.0%	10.0%	None Detected	

Client Sample ID: GIS-250 ***Lab Sample ID:*** **042219669-0040**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-251 ***Lab Sample ID:*** **042219669-0041**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-252 ***Lab Sample ID:*** **042219669-0042**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-253 ***Lab Sample ID:*** **042219669-0043**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-254 ***Lab Sample ID:*** **042219669-0044**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-255 ***Lab Sample ID:*** **042219669-0045**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown/White	30.0%	70.0%	None Detected	

Client Sample ID: GIS-256 ***Lab Sample ID:*** **042219669-0046**

Sample Description: Inside Both Maintenance Closets in Library Hallway/Spray-On Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown/White	30.0%	70.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-257 ***Lab Sample ID:*** **042219669-0047**

Sample Description: Corridor Before Gym North and South/Black Window Ledge

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-258 ***Lab Sample ID:*** **042219669-0048**

Sample Description: Corridor Before Gym North and South/Black Window Ledge

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-259 ***Lab Sample ID:*** **042219669-0049**

Sample Description: Corridor Before Gym North and South/Black Window Ledge

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-260 ***Lab Sample ID:*** **042219669-0050**

Sample Description: Office 110 in Boys Locker Room and Office 111 in Girls Locker Room/Tan 12x12in Floor Tile with Colored Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Tan	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Tan	0.0%	100.0%	None Detected	

Client Sample ID: GIS-262 ***Lab Sample ID:*** **042219669-0051**

Sample Description: Office 110 in Boys Locker Room and Office 111 in Girls Locker Room/Tan 12x12in Floor Tile with Colored Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-264 ***Lab Sample ID:*** **042219669-0052**

Sample Description: Office 110 in Boys Locker Room and Office 111 in Girls Locker Room/Tan 12x12in Floor Tile with Colored Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/19/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-261 ***Lab Sample ID:*** **042219669-0053**

Sample Description: Office 110 in Boys Locker Room and Office 111 in Girls Locker Room/Mastic assocaited w/M-86

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-263 ***Lab Sample ID:*** **042219669-0054**

Sample Description: Office 110 in Boys Locker Room and Office 111 in Girls Locker Room/Mastic assocaited w/M-86

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-265 ***Lab Sample ID:*** **042219669-0055**

Sample Description: Office 110 in Boys Locker Room and Office 111 in Girls Locker Room/Mastic assocaited w/M-86

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-266 ***Lab Sample ID:*** **042219669-0056**

Sample Description: Room 114, Across 114, Across Storage Near 116/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-267 ***Lab Sample ID:*** **042219669-0057**

Sample Description: Room 114, Across 114, Across Storage Near 116/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/17/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-268 ***Lab Sample ID:*** **042219669-0058**

Sample Description: Room 114, Across 114, Across Storage Near 116/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-269 ***Lab Sample ID:*** **042219669-0059**

Sample Description: North Stair Area/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-271 ***Lab Sample ID:*** **042219669-0060**

Sample Description: North Stair Area/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-273 ***Lab Sample ID:*** **042219669-0061**

Sample Description: North Stair Area/Plaster - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-270 ***Lab Sample ID:*** **042219669-0062**

Sample Description: North Stair Area/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown	10.0%	90.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-272 ***Lab Sample ID:*** **042219669-0063**

Sample Description: North Stair Area/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown	10.0%	90.0%	None Detected	

Client Sample ID: GIS-274 ***Lab Sample ID:*** **042219669-0064**

Sample Description: North Stair Area/Plaster - Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown	4.0%	96.0%	None Detected	

Client Sample ID: GIS-275 ***Lab Sample ID:*** **042219669-0065**

Sample Description: Room 109/Red 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-277 ***Lab Sample ID:*** **042219669-0066**

Sample Description: Room 109/Red 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-279 ***Lab Sample ID:*** **042219669-0067**

Sample Description: Room 109/Red 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-276 ***Lab Sample ID:*** **042219669-0068**

Sample Description: Room 109/Mastic associated w/M-91

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow/Clear	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow/Clear	0.0%	100.0%	None Detected	

Client Sample ID: GIS-278 ***Lab Sample ID:*** **042219669-0069**

Sample Description: Room 109/Mastic associated w/M-91

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow/Clear	0.0%	100%	None Detected	

Client Sample ID: GIS-280 ***Lab Sample ID:*** **042219669-0070**

Sample Description: Room 109/Mastic associated w/M-91

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow/Clear	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-281-Baseboard **Lab Sample ID:** **042219669-0071**
Sample Description: Room 109/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-281-Mastic **Lab Sample ID:** **042219669-0071A**
Sample Description: Room 109/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS282-Baseboard **Lab Sample ID:** **042219669-0072**
Sample Description: Room 109/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-282-Mastic **Lab Sample ID:** **042219669-0072A**
Sample Description: Room 109/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-283-Baseboard **Lab Sample ID:** **042219669-0073**
Sample Description: Room 109/Red Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-283-Mastic **Lab Sample ID:** **042219669-0073A**
Sample Description: Room 109/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-284 **Lab Sample ID:** **042219669-0074**
Sample Description: Room 107/Dark Green Tile with Colored Specks 12"X12"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-286 **Lab Sample ID:** **042219669-0075**
Sample Description: Room 107/Dark Green Tile with Colored Specks 12"X12"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-288 ***Lab Sample ID:*** **042219669-0076**

Sample Description: Room 107/Dark Green Tile with Colored Specks 12"X12"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-285 ***Lab Sample ID:*** **042219669-0077**

Sample Description: Room 107/Mastic associated w/M-94

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow/Clear	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow/Clear	0.0%	100.0%	None Detected	

Client Sample ID: GIS-287 ***Lab Sample ID:*** **042219669-0078**

Sample Description: Room 107/Mastic associated w/M-94

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow/Clear	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-289 ***Lab Sample ID:*** **042219669-0079**

Sample Description: Room 107/Mastic associated w/M-94

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022				Insufficient Material	

Client Sample ID: GIS-290-Baseboard ***Lab Sample ID:*** **042219669-0080**

Sample Description: Room 107/Green Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-290-Mastic ***Lab Sample ID:*** **042219669-0080A**

Sample Description: Room 107/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-291-Baseboard ***Lab Sample ID:*** **042219669-0081**

Sample Description: Room 107/Green Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-291-Mastic ***Lab Sample ID:*** **042219669-0081A**

Sample Description: Room 107/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-292-Baseboard **Lab Sample ID:** **042219669-0082**
Sample Description: Room 107/Green Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-292-Mastic **Lab Sample ID:** **042219669-0082A**
Sample Description: Room 107/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-293-Baseboard **Lab Sample ID:** **042219669-0083**
Sample Description: By Stairways/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-293-Mastic **Lab Sample ID:** **042219669-0083A**
Sample Description: By Stairways/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

Client Sample ID: GIS-294-Baseboard **Lab Sample ID:** **042219669-0084**
Sample Description: By Stairways/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-294-Mastic **Lab Sample ID:** **042219669-0084A**
Sample Description: By Stairways/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-295-Baseboard **Lab Sample ID:** **042219669-0085**
Sample Description: By Stairways/Black Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-295-Mastic **Lab Sample ID:** **042219669-0085A**
Sample Description: By Stairways/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-296 ***Lab Sample ID:*** **042219669-0086**

Sample Description: Room 110-1, Principals Office and Staff Rm 105/Light Green Tile with White Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-298 ***Lab Sample ID:*** **042219669-0087**

Sample Description: Room 110-1, Principals Office and Staff Rm 105/Light Green Tile with White Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-300 ***Lab Sample ID:*** **042219669-0088**

Sample Description: Room 110-1, Principals Office and Staff Rm 105/Light Green Tile with White Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-297 ***Lab Sample ID:*** **042219669-0089**

Sample Description: Room 110-1, Principals Office and Staff Rm 105/Mastic assocaited w/M-98

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-299 ***Lab Sample ID:*** **042219669-0090**

Sample Description: Room 110-1, Principals Office and Staff Rm 105/Mastic assocaited w/M-98

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-301 ***Lab Sample ID:*** **042219669-0091**

Sample Description: Room 110-1, Principals Office and Staff Rm 105/Mastic assocaited w/M-98

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-302-Baseboard ***Lab Sample ID:*** **042219669-0092**

Sample Description: Main Office/Burgandy Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-302-Mastic ***Lab Sample ID:*** **042219669-0092A**

Sample Description: Main Office/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

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Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-303-Baseboard ***Lab Sample ID:*** **042219669-0093**

Sample Description: Main Office/Burgandy Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-303-Mastic ***Lab Sample ID:*** **042219669-0093A**

Sample Description: Main Office/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-304-Baseboard ***Lab Sample ID:*** **042219669-0094**

Sample Description: Main Office/Burgandy Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-304-Mastic ***Lab Sample ID:*** **042219669-0094A**

Sample Description: Main Office/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Beige	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-305 ***Lab Sample ID:*** **042219669-0095**

Sample Description: Rooms 109, 107, and 105/12"x12" Tan w/Colored Specks Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Tan	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Tan	0.0%	100.0%	None Detected	

Client Sample ID: GIS-307 ***Lab Sample ID:*** **042219669-0096**

Sample Description: Rooms 109, 107, and 105/12"x12" Tan w/Colored Specks Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-309 ***Lab Sample ID:*** **042219669-0097**

Sample Description: Rooms 109, 107, and 105/12"x12" Tan w/Colored Specks Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-306 ***Lab Sample ID:*** **042219669-0098**

Sample Description: Rooms 109, 107, and 105/Mastic associated w/M-101

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022				Insufficient Material	

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Client Sample ID: GIS-308 ***Lab Sample ID:*** **042219669-0099**

Sample Description: Rooms 109, 107, and 105/Mastic associated w/M-101

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-310 ***Lab Sample ID:*** **042219669-0100**

Sample Description: Rooms 109, 107, and 105/Mastic associated w/M-101

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022				Insufficient Material	

Client Sample ID: GIS-311 ***Lab Sample ID:*** **042219669-0101**

Sample Description: Main Office/Yellow Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-312 ***Lab Sample ID:*** **042219669-0102**

Sample Description: Main Office/Yellow Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-313 ***Lab Sample ID:*** **042219669-0103**

Sample Description: Main Office/Yellow Carpet Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-314 ***Lab Sample ID:*** **042219669-0104**

Sample Description: Noth Stairwell, South Stairwell, Room 107/Pinhole Ceiling Tile 2'x4' White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-315 ***Lab Sample ID:*** **042219669-0105**

Sample Description: Noth Stairwell, South Stairwell, Room 107/Pinhole Ceiling Tile 2'x4' White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-316 ***Lab Sample ID:*** **042219669-0106**

Sample Description: Noth Stairwell, South Stairwell, Room 107/Pinhole Ceiling Tile 2'x4' White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	80.0%	20.0%	None Detected	

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Client Sample ID: GIS-317 ***Lab Sample ID:*** **042219669-0107**

Sample Description: Elevator Area, Level 1/White w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-319 ***Lab Sample ID:*** **042219669-0108**

Sample Description: Elevator Area, Level 1/White w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-321 ***Lab Sample ID:*** **042219669-0109**

Sample Description: Elevator Area, Level 1/White w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-318 ***Lab Sample ID:*** **042219669-0110**

Sample Description: Elevator Area, Level 1/Mastic associated w/M-105

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-320 ***Lab Sample ID:*** **042219669-0111**

Sample Description: Elevator Area, Level 1/Mastic associated w/M-105

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-322 ***Lab Sample ID:*** **042219669-0112**

Sample Description: Elevator Area, Level 1/Mastic associated w/M-105

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-323 ***Lab Sample ID:*** **042219669-0113**

Sample Description: Elevator Area, Level 1/Dark Blue w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-325 ***Lab Sample ID:*** **042219669-0114**

Sample Description: Elevator Area, Level 1/Dark Blue w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	

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Client Sample ID: GIS-327 ***Lab Sample ID:*** **042219669-0115**

Sample Description: Elevator Area, Level 1/Dark Blue w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-324 ***Lab Sample ID:*** **042219669-0116**

Sample Description: Elevator Area, Level 1/Mastic associated w/M-107

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-326 ***Lab Sample ID:*** **042219669-0117**

Sample Description: Elevator Area, Level 1/Mastic associated w/M-107

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-328 ***Lab Sample ID:*** **042219669-0118**

Sample Description: Elevator Area, Level 1/Mastic associated w/M-107

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-329 ***Lab Sample ID:*** **042219669-0119**

Sample Description: South Stairwell Room 105 and 109/Plaster White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-331 ***Lab Sample ID:*** **042219669-0120**

Sample Description: South Stairwell Room 105 and 109/Plaster White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-333 ***Lab Sample ID:*** **042219669-0121**

Sample Description: South Stairwell Room 105 and 109/Plaster White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-330 ***Lab Sample ID:*** **042219669-0122**

Sample Description: South Stairwell Room 105 and 109/Plaster Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown	10.0%	90.0%	None Detected	

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Client Sample ID: GIS-332 ***Lab Sample ID:*** **042219669-0123**
Sample Description: South Stairwell Room 105 and 109/Plaster Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown	0.0%	100.0%	None Detected	The sample group is not homogeneous

Client Sample ID: GIS-334 ***Lab Sample ID:*** **042219669-0124**
Sample Description: South Stairwell Room 105 and 109/Plaster Brown

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GIS-335 ***Lab Sample ID:*** **042219669-0125**
Sample Description: Room 105 Main Office and Room 109/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: GIS-336 ***Lab Sample ID:*** **042219669-0126**
Sample Description: Room 105 Main Office and Room 109/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	15.0%	85.0%	None Detected	

Client Sample ID: GIS-337 ***Lab Sample ID:*** **042219669-0127**
Sample Description: Room 105 Main Office and Room 109/Drywall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown/White	20.0%	80.0%	None Detected	

Client Sample ID: GIS-338 ***Lab Sample ID:*** **042219669-0128**
Sample Description: Nurse Room 106/12"X12" Pink Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Pink	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Pink	0.0%	100.0%	None Detected	

Client Sample ID: GIS-340 ***Lab Sample ID:*** **042219669-0129**
Sample Description: Nurse Room 106/12"X12" Pink Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Pink	0.0%	100%	None Detected	

Client Sample ID: GIS-342 ***Lab Sample ID:*** **042219669-0130**
Sample Description: Nurse Room 106/12"X12" Pink Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Pink	0.0%	100%	None Detected	

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Client Sample ID: GIS-339 ***Lab Sample ID:*** **042219669-0131**

Sample Description: Nurse Room 106/Mastic associated w/M-112

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-341 ***Lab Sample ID:*** **042219669-0132**

Sample Description: Nurse Room 106/Mastic associated w/M-112

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-343 ***Lab Sample ID:*** **042219669-0133**

Sample Description: Nurse Room 106/Mastic associated w/M-112

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-344 ***Lab Sample ID:*** **042219669-0134**

Sample Description: Nurse Room 106/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-345 ***Lab Sample ID:*** **042219669-0135**

Sample Description: Nurse Room 106/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-346 ***Lab Sample ID:*** **042219669-0136**

Sample Description: Nurse Room 106/Black Sink Undercoating

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-347 ***Lab Sample ID:*** **042219669-0137**

Sample Description: Nurse Room 106/Light Green Floor Tile with White Specks 12"x12"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-349 ***Lab Sample ID:*** **042219669-0138**

Sample Description: Nurse Room 106/Light Green Floor Tile with White Specks 12"x12"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	

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Client Sample ID: GIS-351 ***Lab Sample ID:*** **042219669-0139**

Sample Description: Nurse Room 106/Light Green Floor Tile with White Specks 12"x12"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-348 ***Lab Sample ID:*** **042219669-0140**

Sample Description: Nurse Room 106/Mastic assocaited w/M-115

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-350 ***Lab Sample ID:*** **042219669-0141**

Sample Description: Nurse Room 106/Mastic assocaited w/M-115

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-352 ***Lab Sample ID:*** **042219669-0142**

Sample Description: Nurse Room 106/Mastic assocaited w/M-115

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-353 ***Lab Sample ID:*** **042219669-0143**

Sample Description: Nurse Room 106/White 12"x12" Floor Tile w/Green Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	White/Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	White/Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-355 ***Lab Sample ID:*** **042219669-0144**

Sample Description: Nurse Room 106/White 12"x12" Floor Tile w/Green Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	White/Green	0.0%	100%	None Detected	

Client Sample ID: GIS-357 ***Lab Sample ID:*** **042219669-0145**

Sample Description: Nurse Room 106/White 12"x12" Floor Tile w/Green Specks

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	White/Green	0.0%	100%	None Detected	

Client Sample ID: GIS-354 ***Lab Sample ID:*** **042219669-0146**

Sample Description: Nurse Room 106/Mastic associated w/M-117

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-356 ***Lab Sample ID:*** **042219669-0147**
Sample Description: Nurse Room 106/Mastic associated w/M-117

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-358 ***Lab Sample ID:*** **042219669-0148**
Sample Description: Nurse Room 106/Mastic associated w/M-117

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-359 ***Lab Sample ID:*** **042219669-0149**
Sample Description: South Staircase Room 103 and Near Elevator/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-360 ***Lab Sample ID:*** **042219669-0150**
Sample Description: South Staircase Room 103 and Near Elevator/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-361 ***Lab Sample ID:*** **042219669-0151**
Sample Description: South Staircase Room 103 and Near Elevator/Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-362 ***Lab Sample ID:*** **042219669-0152**
Sample Description: Room 103/Carpet Mastic Dark Yellow

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	99.1%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-363 ***Lab Sample ID:*** **042219669-0153**
Sample Description: Room 103/Carpet Mastic Dark Yellow

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Yellow	0.0%	99.0%	None Detected	

Client Sample ID: GIS-364 ***Lab Sample ID:*** **042219669-0154**
Sample Description: Room 103/Carpet Mastic Dark Yellow

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	99.6%	None Detected	

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Client Sample ID: GIS-365 ***Lab Sample ID:*** **042219669-0155**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-366 ***Lab Sample ID:*** **042219669-0156**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-367 ***Lab Sample ID:*** **042219669-0157**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-368 ***Lab Sample ID:*** **042219669-0158**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-369 ***Lab Sample ID:*** **042219669-0159**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-370 ***Lab Sample ID:*** **042219669-0160**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown/White	30.0%	70.0%	None Detected	

Client Sample ID: GIS-371 ***Lab Sample ID:*** **042219669-0161**
Sample Description: Room 103 Ceiling/Spray Insulation White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown/White	25.0%	75.0%	None Detected	

Client Sample ID: GIS-372 ***Lab Sample ID:*** **042219669-0162**
Sample Description: Café/Beige 12"x12" Speckled Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Beige	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-374 ***Lab Sample ID:*** **042219669-0163**

Sample Description: Café/Beige 12"x12" Speckled Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-376 ***Lab Sample ID:*** **042219669-0164**

Sample Description: Café/Beige 12"x12" Speckled Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Beige	0.0%	100%	None Detected	

Client Sample ID: GIS-373 ***Lab Sample ID:*** **042219669-0165**

Sample Description: Café/Mastic associated w/M-122

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-375 ***Lab Sample ID:*** **042219669-0166**

Sample Description: Café/Mastic associated w/M-122

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-377 ***Lab Sample ID:*** **042219669-0167**

Sample Description: Café/Mastic associated w/M-122

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-378 ***Lab Sample ID:*** **042219669-0168**

Sample Description: Café/Red 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-380 ***Lab Sample ID:*** **042219669-0169**

Sample Description: Café/Red 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-382 ***Lab Sample ID:*** **042219669-0170**

Sample Description: Café/Red 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

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Client Sample ID: GIS-379 ***Lab Sample ID:*** **042219669-0171**

Sample Description: Café/Mastic associated w/M-124

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-381 ***Lab Sample ID:*** **042219669-0172**

Sample Description: Café/Mastic associated w/M-124

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-383 ***Lab Sample ID:*** **042219669-0173**

Sample Description: Café/Mastic associated w/M-124

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-384 ***Lab Sample ID:*** **042219669-0174**

Sample Description: Café/Green 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Green	0.0%	100.0%	None Detected	

Client Sample ID: GIS-386 ***Lab Sample ID:*** **042219669-0175**

Sample Description: Café/Green 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-388 ***Lab Sample ID:*** **042219669-0176**

Sample Description: Café/Green 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Green	0.0%	100%	None Detected	

Client Sample ID: GIS-385 ***Lab Sample ID:*** **042219669-0177**

Sample Description: Café/Mastic assocaited w/M-126

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-387 ***Lab Sample ID:*** **042219669-0178**

Sample Description: Café/Mastic assocaited w/M-126

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

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Client Sample ID: GIS-389 ***Lab Sample ID:*** **042219669-0179**

Sample Description: Café/Mastic assocaited w/M-126

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-390 ***Lab Sample ID:*** **042219669-0180**

Sample Description: Café/Blue 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-392 ***Lab Sample ID:*** **042219669-0181**

Sample Description: Café/Blue 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-394 ***Lab Sample ID:*** **042219669-0182**

Sample Description: Café/Blue 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-391 ***Lab Sample ID:*** **042219669-0183**

Sample Description: Café/Mastic associated w/ M-128

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-393 ***Lab Sample ID:*** **042219669-0184**

Sample Description: Café/Mastic associated w/ M-128

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-395 ***Lab Sample ID:*** **042219669-0185**

Sample Description: Café/Mastic associated w/ M-128

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-396-Baseboard ***Lab Sample ID:*** **042219669-0186**

Sample Description: Café/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/16/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-396-Mastic ***Lab Sample ID:*** **042219669-0186A**

Sample Description: Café/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-397-Baseboard ***Lab Sample ID:*** **042219669-0187**

Sample Description: Café/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-397-Mastic ***Lab Sample ID:*** **042219669-0187A**

Sample Description: Café/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-398-Baseboard ***Lab Sample ID:*** **042219669-0188**

Sample Description: Café/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-398-Mastic ***Lab Sample ID:*** **042219669-0188A**

Sample Description: Café/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-399-Baseboard ***Lab Sample ID:*** **042219669-0189**

Sample Description: Café Hallway/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-399-Mastic ***Lab Sample ID:*** **042219669-0189A**

Sample Description: Café Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GIS-400-Baseboard ***Lab Sample ID:*** **042219669-0190**

Sample Description: Café Hallway/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

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Client Sample ID: GIS-400-Mastic **Lab Sample ID:** **042219669-0190A**
Sample Description: Café Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-401-Baseboard **Lab Sample ID:** **042219669-0191**
Sample Description: Café Hallway/Blue Baseboard

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-401-Mastic **Lab Sample ID:** **042219669-0191A**
Sample Description: Café Hallway/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Yellow	0.0%	100%	None Detected	

Client Sample ID: GIS-402 **Lab Sample ID:** **042219669-0192**
Sample Description: Back Entrance Ramp/Teal 12"x12" Linoleum Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Blue	0.0%	100.0%	None Detected	

Client Sample ID: GIS-404 **Lab Sample ID:** **042219669-0193**
Sample Description: Back Entrance Ramp/Teal 12"x12" Linoleum Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-406 **Lab Sample ID:** **042219669-0194**
Sample Description: Back Entrance Ramp/Teal 12"x12" Linoleum Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Blue	0.0%	100%	None Detected	

Client Sample ID: GIS-403 **Lab Sample ID:** **042219669-0195**
Sample Description: Back Entrance Ramp/Mastic assocaited w/M-132

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022				Insufficient Material	

Client Sample ID: GIS-405 **Lab Sample ID:** **042219669-0196**
Sample Description: Back Entrance Ramp/Mastic assocaited w/M-132

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

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Client Sample ID: GIS-407 ***Lab Sample ID:*** **042219669-0197**

Sample Description: Back Entrance Ramp/Mastic assocaited w/M-132

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-408 ***Lab Sample ID:*** **042219669-0198**

Sample Description: Back Entrance/White w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-410 ***Lab Sample ID:*** **042219669-0199**

Sample Description: Back Entrance/White w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-412 ***Lab Sample ID:*** **042219669-0200**

Sample Description: Back Entrance/White w/Specks 12"x12" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	White	0.0%	100%	None Detected	

Client Sample ID: GIS-409 ***Lab Sample ID:*** **042219669-0201**

Sample Description: Back Entrance/Mastic associated w/M-134

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GIS-411 ***Lab Sample ID:*** **042219669-0202**

Sample Description: Back Entrance/Mastic associated w/M-134

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GIS-413 ***Lab Sample ID:*** **042219669-0203**

Sample Description: Back Entrance/Mastic associated w/M-134

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black	0.0%	100%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-414 ***Lab Sample ID:*** **042219669-0204**

Sample Description: Café Hallway/White 2'x2' Pinhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	75.0%	25.0%	None Detected	

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Client Sample ID: GIS-415 ***Lab Sample ID:*** **042219669-0205**
Sample Description: Café Hallway/White 2'x2' Pinhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	75.0%	25.0%	None Detected	

Client Sample ID: GIS-416 ***Lab Sample ID:*** **042219669-0206**
Sample Description: Café Hallway/White 2'x2' Pinhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	75.0%	25.0%	None Detected	

Client Sample ID: GIS-417 ***Lab Sample ID:*** **042219669-0207**
Sample Description: Café Hallway/White 2x4' Pinhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	75.0%	25.0%	None Detected	

Client Sample ID: GIS-418 ***Lab Sample ID:*** **042219669-0208**
Sample Description: Café Hallway/White 2x4' Pinhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	White	80.0%	20.0%	None Detected	

Client Sample ID: GIS-419 ***Lab Sample ID:*** **042219669-0209**
Sample Description: Café Hallway/White 2x4' Pinhole Ceiling Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	White	75.0%	25.0%	None Detected	

Client Sample ID: GIS-420 ***Lab Sample ID:*** **042219669-0210**
Sample Description: Room 100/Mastic for Carpet

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Tan	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Tan	0.0%	100.0%	None Detected	

Client Sample ID: GIS-421 ***Lab Sample ID:*** **042219669-0211**
Sample Description: Room 100/Mastic for Carpet

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Tan	0.0%	100%	None Detected	

Client Sample ID: GIS-422 ***Lab Sample ID:*** **042219669-0212**
Sample Description: Room 100/Mastic for Carpet

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Tan	0.0%	100%	None Detected	

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Client Sample ID: GIS-423 ***Lab Sample ID:*** **042219669-0213**

Sample Description: Basement by Street/Boiler Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	15.0%	85.0%	None Detected	

Client Sample ID: GIS-424 ***Lab Sample ID:*** **042219669-0214**

Sample Description: Basement by Street/Boiler Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	20.0%	80.0%	None Detected	

Client Sample ID: GIS-425 ***Lab Sample ID:*** **042219669-0215**

Sample Description: Basement by Street/Boiler Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray	40.0%	60.0%	None Detected	

Client Sample ID: GIS-426 ***Lab Sample ID:*** **042219669-0216**

Sample Description: Basement by Street/Boiler Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	20.0%	80.0%	None Detected	

Client Sample ID: GIS-427 ***Lab Sample ID:*** **042219669-0217**

Sample Description: Basement by Street/Boiler Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	20.0%	80.0%	None Detected	

Client Sample ID: GIS-428 ***Lab Sample ID:*** **042219669-0218**

Sample Description: Basement by Street/Boiler Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray	35.0%	65.0%	None Detected	

Client Sample ID: GIS-429 ***Lab Sample ID:*** **042219669-0219**

Sample Description: Basement by Street/Red Boiler Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-430 ***Lab Sample ID:*** **042219669-0220**

Sample Description: Basement by Street/Red Boiler Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

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EMSL Order ID:	042219669
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	

Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-431 ***Lab Sample ID:*** **042219669-0221**
Sample Description: Basement by Street/Red Boiler Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-432 ***Lab Sample ID:*** **042219669-0222**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	25.0%	75.0%	None Detected	

Client Sample ID: GIS-433 ***Lab Sample ID:*** **042219669-0223**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	25.0%	75.0%	None Detected	

Client Sample ID: GIS-434 ***Lab Sample ID:*** **042219669-0224**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	30.0%	70.0%	None Detected	

Client Sample ID: GIS-435 ***Lab Sample ID:*** **042219669-0225**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	30.0%	70.0%	None Detected	

Client Sample ID: GIS-436 ***Lab Sample ID:*** **042219669-0226**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Gray	30.0%	70.0%	None Detected	

Client Sample ID: GIS-437 ***Lab Sample ID:*** **042219669-0227**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray	30.0%	70.0%	None Detected	

Client Sample ID: GIS-438 ***Lab Sample ID:*** **042219669-0228**
Sample Description: Basement by Street/Gray Spray-on Insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Gray	30.0%	70.0%	None Detected	

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EMSL Order ID:	042219669
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	

Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-439 ***Lab Sample ID:*** **042219669-0229**

Sample Description: Basement 1st Room on Right/Brown 9"x9" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Brown	0.0%	97.0%	**3.0% Chrysotile**	

Client Sample ID: GIS-441 ***Lab Sample ID:*** **042219669-0230**

Sample Description: Basement 1st Room on Right/Brown 9"x9" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Brown	0.0%	97.0%	**3.0% Chrysotile**	

Client Sample ID: GIS-443 ***Lab Sample ID:*** **042219669-0231**

Sample Description: Basement 1st Room on Right/Brown 9"x9" Floor Tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Brown	0.0%	95.6%	**4.4% Chrysotile**	

Client Sample ID: GIS-440 ***Lab Sample ID:*** **042219669-0232**

Sample Description: Basement 1st Room on Right/Mastic associated w/M-143

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black/Yellow	0.0%	100%	**<0.25% Chrysotile**	
TEM Grav. Reduction	8/21/2022	Black/Yellow	0.00%	99.59%	**0.41% Chrysotile**	

Client Sample ID: GIS-442 ***Lab Sample ID:*** **042219669-0233**

Sample Description: Basement 1st Room on Right/Mastic associated w/M-143

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black/Yellow	0.0%	99.6%	**0.40% Chrysotile**	

Client Sample ID: GIS-444 ***Lab Sample ID:*** **042219669-0234**

Sample Description: Basement 1st Room on Right/Mastic associated w/M-143

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Black/Yellow	0.0%	99.6%	**0.37% Chrysotile**	Result includes a small amount of inseparable attached material

Client Sample ID: GIS-445 ***Lab Sample ID:*** **042219669-0235**

Sample Description: Emergency Fire Exit/Fire Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	
TEM Grav. Reduction	8/21/2022	Red	0.0%	100.0%	None Detected	

Client Sample ID: GIS-446 ***Lab Sample ID:*** **042219669-0236**

Sample Description: Emergency Fire Exit/Fire Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

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Customer PO:	1200-42
Project ID:	

Summary Test Report for Asbestos Analysis of Bulk Material via EPA 600/R-93/116

Client Sample ID: GIS-447 ***Lab Sample ID:*** **042219669-0237**

Sample Description: Emergency Fire Exit/Fire Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/17/2022	Red	0.0%	100%	None Detected	

Client Sample ID: GIS-448 ***Lab Sample ID:*** **042219669-0238**

Sample Description: Crawlspace in Back Street Basement/Debris from Crawl Space

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown	5.0%	95.0%	None Detected	

Client Sample ID: GIS-449 ***Lab Sample ID:*** **042219669-0239**

Sample Description: Crawlspace in Back Street Basement/Debris from Crawl Space

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/18/2022	Brown	5.0%	95.0%	None Detected	

Client Sample ID: GIS-450 ***Lab Sample ID:*** **042219669-0240**

Sample Description: Crawlspace in Back Street Basement/Debris from Crawl Space

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/19/2022	Brown	0.0%	100.0%	None Detected	

Analyst(s):

Andrea Doughty	PLM (53) PLM Grav. Reduction (73)
Daniel Blake	TEM Grav. Reduction (62)
John Witcraft	PLM (12)
Julianna Hosbach	PLM Grav. Reduction (99)
Laura Kantor	PLM (13) PLM Grav. Reduction (12)

Reviewed and approved by:

Samantha Rundstrom, Laboratory Manager
or Other Approved Signatory

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Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ PA ID# 68-00367, NVLAP Lab Code 101048-0

Initial report from: 08/22/202209:48:33

OrderID: 042219669

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EMSL Order Number *(Lab Use Only)*: 042219669

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PHONE: (800) 220-3675
FAX: (856) 786-5973

Company : PARS Environmental	**EMSL-Bill to:** ☒ Same ☐ Different If Bill to is Different note instructions in Comments** *Third Party Billing requires written authorization from third party*
Street: 500 Horizon Drive, Suite 540	
City: Robbinsville / **State/Province: NJ**	**Zip/Postal Code: 08691** / **Country: USA**
Report To (Name): Julian Fernandez-Obregon	**Fax #: 609-890-9116**
Telephone #: 609-890-7277	**Email Address: jfernandez@montrose-env.com**
Project Name/Number: Glassboro Intermediate School	
Please Provide Results: ☐ Fax ☒ Email	**Purchase Order: 1200-42** / **U.S. State Samples Taken: NJ**

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☒ 1 Week ☐ 2 Week

**For TEM Air 3 hr through 6 hr, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air
- ☐ NIOSH 7400
- ☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
- ☒ PLM EPA 600/R-93/116 (<1%)
- ☒ PLM EPA NOB (<1%)

Point Count
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)

Point Count w/Gravimetric
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- ☐ NYS 198.1 (friable in NY)
- ☐ NYS 198.6 NOB (non-friable-NY)
- ☐ NIOSH 9002 (<1%)

TEM – Air ☐ **4-4.5hr TAT (AHERA only)**
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312

TEM - Bulk
- ☒ TEM EPA NOB
- ☐ NYS NOB 198.4 (non-friable-NY)
- ☐ Chatfield SOP
- ☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2
- Fibers >10µm ☐ Waste ☐ Drinking
- All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
- ☐ Microvac - ASTM D 5755
- ☐ Wipe - ASTM D6480
- ☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
- ☐ PLM CARB 435 - A (0.25% sensitivity)
- ☐ PLM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - C (0.01% sensitivity)
- ☐ EPA Protocol (Semi-Quantitative)
- ☐ EPA Protocol (Quantitative)

Other:
- ☐

☐ **Check For Positive Stop – Clearly Identify Homogenous Group**

Samplers Name: Marissa Weinstein | **Samplers Signature:** Marissa Weinstein

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
	See Attached		

Client Sample # (s): - **Total # of Samples:** ~~239~~ 240

Relinquished (Client): Marissa Weinstein **Date:** 8/9/2022 **Time:**

Received (Lab): [illegible] **Date:** 8/9/22 **Time:** 330

Comments/Special Instructions:

042219669

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: MW Site Location GIS Page: 2

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-71	Dark blue stair tread	GIS-211 GIS-212 GIS-213	South Stairs	500 SF	D	
M-72	Dark blue 12x12 in floor tile	GIS-214 GIS-216 GIS-218	1st level by Room 114	451 SF	D	
M-73	Mastic associated with M-72	GIS-215 GIS-217 GIS-219	1st level by Room 114	451 SF	D	
M-74	White with Gray specks 12x12 floor tile	GIS-220 GIS-222 GIS-224	1st level by Room 114	451 SF	D	
M-75	Mastic associated with M-74	GIS-221 GIS-223 GIS-225	1st level by Room 114	451 SF	D	
M-76	Red baseboard and mastic	GIS-226 GIS-227 GIS-228	Room 114	200 SF	D	
M-77	Blue baseboard and Mastic	GIS-229 GIS-230 GIS-231	Hallway outside library, Library	200 SF	D	
M-78	Carpet Mastic	GIS-232 GIS-233 GIS-234	Library and Room 114	5500 SF	D	
S-79	Plaster - White	GIS-235 GIS-237 GIS-239	Library, Hallway outside Library, closet across 114	3000 SF	D	
S-80	Plaster - Brown	GIS-236 GIS-238 GIS-240	Library, Hallway outside Library, closet across 114	3000 SF	D	

Signature: Date Sampled: 7/29/22 PARS Project #: 1200-42

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Sampling Technician: MW Site Location GIS Page: 3

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HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-81	Drywall	GIS-241 GIS-242 GIS-243	Inside storage near 116 116 and, 114	1000 SF	D	
M-82	Pinhole white 2x4' ceiling tile	GIS-244 GIS-245 GIS-246	Hallway outside library	500 SF	D	
M-83	Pinhole with small circular crater white 2x4' ceiling tile	GIS-247 GIS-248 GIS-249	Inside storage near 116, Hall outside storage outside 114	200 SF	D	
T-84	Spray-on insulation	GIS-250 GIS-251 GIS-252 GIS-253 GIS-254 GIS-255 GIS-256	Inside both maintenance closets in library hallway	200 SF	D	
M-85	Black window ledge	GIS-257 GIS-258 GIS-259	Corridor before gym north + South	20 SF	D	
M-86	Tan 12x12 in floor tile with colored specks	GIS-260 GIS-262 GIS-264	Office 110 in boys locker Room and Office 111 in girls locker room	300 SF	D	
M-87	Mastic associated w/ M-86	GIS-261 GIS-263 GIS-265	Office 110 and 111	300 SF	D	
M-88	Joint Compound	GIS-266 GIS-267 GIS-268	Room 114, across 114, across storage near 116	100 SF	D	
S-89	Plaster - White	GIS-269 GIS-271 GIS-273	North stairwell area	1000 SF	D	
S-90	Plaster - Brown	GIS-270 GIS-272 GIS-274	North stairwell area	1000 SF	D	

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Sampling Technician: MW Site Location GIS Page: 4

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-91	Red 12x12" floor tile	GIS-275 GIS-277 GIS-277	Room 109	614 SF	D	
M-92	Mastic associated w/ M-91	GIS-276 GIS-278 GIS-280	Room 109	614 SF	D	
M-93	Red Baseboard & Mastic	GIS-281 GIS-282 GIS-283	Room 109	200 SF	D	
M-94	Dark Green floor tile with colored specks 12x12"	GIS-284 GIS-286 GIS-288	Room 107	641 SF	D	
M-95	Mastic associated w/ M-94	GIS-285 GIS-287 GIS-289	Room 107	641 SF	D	
M-96	Green baseboard and mastic	GIS-290 GIS-291 GIS-292	Room 107	200 SF	D	
M-97	Black baseboard and Mastic	GIS-293 GIS-294 GIS-295	By stairways	100 SF	D	
M-98	Light green tile with white specks	GIS-296 GIS-298 GIS-300	Room 110-1, Principals office, and staff lounge	1200 SF	D	
M-99	Mastic associated with M-98	GIS-297 GIS-299 GIS-301	Room 110-1, Principals office, and staff lounge	1200 SF	D	
M-100	Burgandy baseboard and mastic	GIS-302 GIS-303 GIS-304	Main office	200 SF	D	

Signature: Marin West Date Sampled: 7/29/2022 PARS Project #: 1200-42

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Sampling Technician: MW Site Location GIS Page: 5

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-101	12"x12" Tan w/ Colored Specks Floor Tile	GIS-305 GIS-307 GIS-309	Rooms 109, 107, and 105	2200 SF	D	
M-102	Mastic Associated w/M-101	GIS-306 GIS-308 GIS-310	Rooms 109, 107, and 105	2200 SF	D	
M-103	Yellow Carpet Mastic	GIS-311 GIS-312 GIS-313	main office	917 SF	D	
M-104	Pinhole 2'x4' Ceiling Tile White	GIS-314 GIS-315 GIS-316	North Stairwell, South Stairwell, Room 107	3000 SF	D	
M-105	White w/ Specks 12"x12" Floor Tile	GIS-317 GIS-319 GIS-321	Elevator Area, Level 1	130 SF	D	
M-106	Mastic Associated w/ M-105	GIS-318 GIS-320 GIS-322	Elevator Area, Level 1	130 SF	D	
M-107	Dark Blue w/ Specks 12"x 12" Floor Tile	GIS-323 GIS-325 GIS-327	Elevator Area Level 1	130 SF	D	
M-108	Mastic Associated w/ M-107	GIS-324 GIS-326 GIS-328	Elevator Area, Level 1	130 SF	D	
S-109	Plaster-White	GIS-329 GIS-331 GIS-333	South Stairwell, Room 105 and 109	3000 SF	D	
S-110	Plaster - Brown	GIS-330 GIS-332 GIS-334	South Stairwell, Room 105 and 109	3000 SF	D	

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HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-111	Dry Wall	GIS-335 GIS-336 GIS-337	Room 105 Main office and Room 109	1000 SF	D	
M-112	12"x12" Pink Floor Tile	GIS-338 GIS-340 GIS-342	Nurse Room 106	768 SF	D	
M-113	Mastic Associated W/ M-112	GIS-339 GIS-341 GIS-343	Nurse Room 106	768 SF	D	
M-114	Black Sink undercoating	GIS-344 GIS-345 GIS-346	Nurse 106	5 SF	D	
M-115	Light green floor tile with white specks 12" x 12"	GIS-347 GIS-349 GIS-351	Nurse 106	768 SF	D	
M-116	Mastic Associated with M-115	GIS-348 GIS-350 GIS-352	Nurse 106	768 SF	D	
M-117	White 12"x12" floor tile with green specks	GIS-353 GIS-355 GIS-357	Nurse 106	768 SF	D	
M-118	Mastic Associated with M-117	GIS-354 GIS-356 GIS-358	Nurse 106	768 SF	D	
M-119	Joint compound	GIS-359 GIS-360 GIS-361	South stair case, Room 103, and near elevator	1000 SF	D	
M-120	carpet Mastic dark yellow	GIS-362 GIS-363 GIS-364	Room 103	SF	D	

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Signature: Marina Wurst Date Sampled: 7/29/2022 PARS Project #: 1200-42

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Sampling Technician: MW Site Location GIS Page: 7

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
S-121	Spray Insulation White	GIS-365, 366, 367 GIS-368, 369, 370, 371	Room 103 Ceiling	1246 SF	D	
m-122	Beige 12"x12" speckled Floor Tile	GIS-372 GIS-374 GIS-376	Cafe	700 SF	D	
m-123	mastic Associated w/ m-122	GIS-373 GIS-375 GIS-377	Cafe	706 SF	D	
m-124	Red 12"x12" Floor Tile	GIS-378 GIS-380 GIS-382	Cafe	20 SF	D	
m-125	mastic Associated w/ m-124	GIS-379 GIS-381 GIS-383	Cafe	20 SF	D	
m-126	Green 12"x12" Floor Tile	GIS-384 GIS-386 GIS-388	Cafe	20 SF	D	
m-127	mastic Associated w/ m-126	GIS-385 GIS-387 GIS-389	Cafe	20 SF	D	
m-128	Blue 12"x12" Floor Tile	GIS-390 GIS-392 GIS-394	Cafe	20 SF	D	
m-129	mastic Associated w/ m-128	GIS-391 GIS-393 GIS-395	Cafe	20 SF	D	
m-130	Blue Baseboard w/ mastic	GIS-396 GIS-397 GIS-398	Cafe	59 SF	D	

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Sampling Technician: MW Site Location GIS Page: 8

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-131	Blue Base board and mastic	GIS-399 GIS-400 GIS-401	Cafe hallway	700 SF	D	
M-132	Teal 12" x12" Linoleum Floor tile	GIS-402 GIS-404 GIS-406	Back entrance Ramp	251 SF	D	
M-133	Mastic Associated W/ M-132	GIS-403 GIS-405 GIS-407	Back entrance Ramp	251 SF	D	
M-134	white w/specks 12"x12" Floor tile	GIS-408 GIS-410 GIS-412	Back entrance	95 SF	D	
M-135	Mastic Associated W/ M-134	GIS-409 GIS-411 GIS-413	Back entrance	95 SF	D	
M-136	White 2x2' Pinhole Ceiling tile	GIS-414 GIS-415 GIS-416	Cafe hallway	751 SF	D	
M-137	White 2x4' Pinhole ceiling tile	GIS-417 GIS-418 GIS-419	Cafe hallway	751 SF	D	
M-138	Mastic For Carpet, Fun	GIS-420 GIS-421 GIS-422	Room 100	1372 SF	D	
M-139	Boiler insulation Gray	GIS-423 GIS-424 GIS-425	Basement by Street	100 SF	D	
M-140	Boiler insulation Gray 2	GIS-426 GIS-427 GIS-428	Basement Street	100	D	

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Sampling Technician: MW Site Location GIS Page: 9

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
m-141	Red Boiler Caulk	GIS-429 GIS-430 GIS-431	Basement by Street	2SF	D	
S-142	Gray Spray-on Insulation	GIS-432, 433, 434 GIS-435, 436, 437, 438	Basement by Back-street	241 SF	D	
m-143	Brown 9"x9" Floor Tile	GIS-439 GIS-441 GIS-443	Basement (1st Room on Right)	494 SF	D	
m-144	Mastic Associated w/ m-143	GIS-440 GIS-442 GIS-444	Basement (1st Room on Right)	494 SF	D	
m-145	Fire Caulk	GIS-445 GIS-446 GIS-447.	Emergency Fire Exit	2SF	D	
m-146	Debris from crawlspace	GIS-448 GIS-449 GIS-450	Crawlspace in Back-street basement	100 SF	D	

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Lead (Pb) Chain of Custody

EMSL Order ID *(Lab Use Only)*: 202207061

EMSL ANALYTICAL, INC.
200 ROUTE 130 N
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5973

Company : PARS Environmental		**EMSL-Bill to:** ☒ Same ☐ Different If Bill to is Different note instructions in Comments**	
Street: 500 Horizon Drive, Suite 540		*Third Party Billing requires written authorization from third party*	
City: Robbinsville	**State/Province: NJ**	**Zip/Postal Code: 08691**	**Country: USA**
Report To (Name): Julian Fernandez-Obregon		**Fax #: 609-890-9116**	
Telephone #: 609-890-7277		**Email Address: jfernandez@montrose-env.com**	
Project Name/Number: Rowan - GIS			
Please Provide Results: ☐ Fax ☒ Email	**Purchase Order: 1200-42**	**U.S. State Samples Taken: NJ**	

Turnaround Time (TAT) Options* - Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☒ 1 Week ☐ 2 Week

**Analysis completed in accordance with EMSL's Terms and Conditions located in the Price Guide*

Matrix	Method	Instrument	Reporting Limit	Check
Chips ☐ mg/cm² ☒ % by wt.	SW846-7000B/7420 or AOAC 974.02	Flame Atomic Absorption	0.01%	☒
Air	NIOSH 7082	Flame Atomic Absorption	4 µg/filter	☐
	NIOSH 7105	Graphite Furnace AA	0.03 µg/filter	☐
	NIOSH 7300 modified	ICP-AES	0.5 µg/filter	☐
Wipe* ☐ ASTM ☐ non ASTM *if no box is checked, non-ASTM Wipe is assumed	SW846-7000B/7420	Flame Atomic Absorption	10 µg/wipe	☐
	SW846-6010B or C	ICP-AES	0.5 µg/wipe	☐
TCLP	SW846-1311/7420/SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	SW846-6010B or C	ICP-AES	0.1 mg/L (ppm)	☐
Soil	SW846-7000B/7420	Flame Atomic Absorption	40 mg/kg (ppm)	☐
	SW846-7421	Graphite Furnace AA	0.3 mg/kg (ppm)	☐
	SW846-6010B or C	ICP-AES	1 mg/kg (ppm)	☐
Wastewater	SM3111B or SW846-7000B/7420	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)	☐
	SW846-6010B or C	ICP-AES	1 mg/kg (ppm)	☐
Drinking Water	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)	☐

Other:	**Preservation Method (Water):**
Name of Sampler: Marissa Weinstein	**Signature of Sampler:** Marissa Weinstein

Sample #	Location	Volume/Area	Date/Time Sampled
GISL-1	3rd FL Hall Beige Window Sills	N/A	7/28/2022
GISL-2	3rd FL Hall Gray Baseboard	N/A	7/28/2022
GISL-3	310 Beige Wall	N/A	7/28/2022
GISL-4	North Stairwell Beige Wall	N/A	7/28/2022
GISL-5	305 Beige Wall	N/A	7/28/2022
GISL-6	306 Beige Bay Window	N/A	7/28/2022

Client Sample #'s	-			**Total # of Samples:**	32
Relinquished (Client):	Marissa Weinstein	**Date:**	8/10/2022	**Time:**	
Received (Lab):	WI	**Date:**	8/10/22	**Time:**	3:10
Comments:					

OrderID: 202207061

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

LEAD (Pb) CHAIN OF CUSTODY

EMSL ORDER ID *(Lab Use Only):*

202207061

EMSL ANALYTICAL
200 ROUTE 130 N
CINNAMINSON, NJ
PHONE: (800) 220-3675
FAX: (856) 786-5973

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Location	Volume/Area	Date/Time Sampled
GISL-7	304 Beige Window	N/A	7/28/2022
GISL-8	303 Beige Window Sill	N/A	7/28/2022
GISL-9	217 Beige Wall	N/A	7/28/2022
GISL-10	219 Beige Wood Trim	N/A	7/28/2022
GISL-11	2nd FL North Hall Beige Wall	N/A	7/28/2022
GISL-12	215 Aqua Door	N/A	7/28/2022
GISL-13	North Hall Stairwell Beige Wall	N/A	7/28/2022
GISL-14	200 Beige Window Sill	N/A	7/28/2022
GISL-15	Exterior Door #01 White	N/A	7/28/2022
GISL-16	116 Hall Beige Wall	N/A	7/28/2022
GISL-17	Library 112 Beige Wall	N/A	7/29/2022
GISL-18	Hallway by 112 Mustard Beige Wall	N/A	7/29/2022
GISL-19	109 Beige Wall	N/A	7/29/2022
GISL-20	110-3 Beige Ceiling not recieved/ 8/15/22 Rec'd 10am.	N/A	7/29/2022
GISL-21	Staff Dining 105 Beige Wall	N/A	7/29/2022
GISL-22	Cafeteria 104 Beige Wall	N/A	7/29/2022
GISL-23	Hallway by 103 Gray Floor	N/A	7/29/2022
GISL-24	Hallway by 106 Beige Wall	N/A	7/29/2022

Comments/Special Instructions:

Controlled Document — Lead (Pb) COC – R2– 1/12/2010

Page 2 Of 3

EMSL ANALYTICAL, INC.
LABORATORY - PRODUCTS - TRAINING

LEAD (Pb) CHAIN OF CUSTODY

EMSL ORDER ID *(Lab Use Only):*

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200 ROUTE 130 N
CINNAMINSON, NJ
PHONE: (800) 220-3675
FAX: (856) 786-5973

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Location	Volume/Area	Date/Time Sampled
GISL-25	Kitchen White Wall	N/A	7/29/2022
GISL-26	Hallway by 100	N/A	7/29/2022
GISL-27	Basement by Back-Street Gray Floor	N/A	7/29/2022
GISL-28	Basement by Back-Street Green Wall	N/A	7/29/2022
GISL-29	Basement by Back-Street Hallway White Wall	N/A	7/29/2022
GISL-30	Basement by Back-Street Gray Baseboard	N/A	7/29/2022
GISL-31	Basement by Street White Door	N/A	7/29/2022
GISL-32	Basement by Street Red Door	N/A	7/29/2022

Comments/Special Instructions:

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.EMSL.com cinnaminsonleadlab@emsl.com

EMSL Order:	202207061
CustomerID:	PARS51
CustomerPO:	1200-42
ProjectID:	

Attn: **Julian Fernandez-Obregon**
PARS Environmental
500 Horizon Drive
Suite 540
Robbinsville, NJ 08691

Phone:	(609) 890-7277
Fax:	(609) 890-9116
Received:	8/15/2022 10:00 AM
Collected:	7/28/2022

Project: **ROWAN - GIS**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Weight*	*Lead Concentration*
GISL-1	*202207061-0001*	7/28/2022	8/17/2022	0.2835 g	0.012 % wt
	Site: 3RD FL HALL BEIGE WINDOW SILLS				
GISL-2	*202207061-0002*	7/28/2022	8/17/2022	0.2878 g	<0.0080 % wt
	Site: 3RD FL HALL GRAY BASEBOARD				
GISL-3	*202207061-0003*	7/28/2022	8/17/2022	0.2591 g	0.010 % wt
	Site: 310 BEIGE WALL				
GISL-4	*202207061-0004*	7/28/2022	8/17/2022	0.2543 g	0.23 % wt
	Site: NORTH STAIRWELL BEIGE WALL				
GISL-5	*202207061-0005*	7/28/2022	8/17/2022	0.2609 g	0.19 % wt
	Site: 305 BEIGE WALL				
GISL-6	*202207061-0006*	7/28/2022	8/17/2022	0.2651 g	0.048 % wt
	Site: 306 BEIGE BAY WINDOW				
GISL-7	*202207061-0007*	7/28/2022	8/17/2022	0.2626 g	1.5 % wt
	Site: 304 BEIGE WINDOW				
GISL-8	*202207061-0008*	7/28/2022	8/17/2022	0.2821 g	0.47 % wt
	Site: 303 BEIGE WINDOW SILL				
GISL-9	*202207061-0009*	7/28/2022	8/17/2022	0.2897 g	0.29 % wt
	Site: 217 BEIGE WALL				
GISL-10	*202207061-0010*	7/28/2022	8/17/2022	0.2745 g	0.078 % wt
	Site: 219 BEIGE WOOD TRIM				
GISL-11	*202207061-0011*	7/28/2022	8/17/2022	0.2631 g	<0.0080 % wt
	Site: 2ND FL NORTH HALL BEIGE WALL				
GISL-12	*202207061-0012*	7/28/2022	8/17/2022	0.2608 g	0.11 % wt
	Site: 215 AQUA DOOR				
GISL-13	*202207061-0013*	7/28/2022	8/17/2022	0.2632 g	<0.0080 % wt
	Site: NORTH HALL STAIRWELL BEIGE WALL				
GISL-14	*202207061-0014*	7/28/2022	8/17/2022	0.2843 g	0.094 % wt
	Site: 200 BEIGE WINDOW SILL				
GISL-15	*202207061-0015*	7/28/2022	8/17/2022	0.2638 g	16 % wt
	Site: EXTERIOR DOOR #01 WHITE				

Owen Mckenna, Lead Laboratory Director
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted.
* Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request.
Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 08/17/2022 16:32:52

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.EMSL.com cinnaminsonleadlab@emsl.com

EMSL Order:	202207061
CustomerID:	PARS51
CustomerPO:	1200-42
ProjectID:	

Attn: **Julian Fernandez-Obregon**
PARS Environmental
500 Horizon Drive
Suite 540
Robbinsville, NJ 08691

Phone:	(609) 890-7277
Fax:	(609) 890-9116
Received:	8/15/2022 10:00 AM
Collected:	7/28/2022

Project: **ROWAN - GIS**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Weight*	*Lead Concentration*
GISL-16	*202207061-0016*	7/28/2022	8/17/2022	0.2540 g	<0.0080 % wt
	Site: 116 HALL BEIGE WALL				
GISL-17	*202207061-0017*	7/28/2022	8/17/2022	0.2523 g	0.21 % wt
	Site: LIBRARY 112 BEIGE WALL				
GISL-18	*202207061-0018*	7/28/2022	8/17/2022	0.2553 g	<0.0080 % wt
	Site: HALLWAY BY 112 MUSTARD BEIGE WALL				
GISL-19	*202207061-0019*	7/28/2022	8/17/2022	0.2925 g	<0.0080 % wt
	Site: 109 BEIGE WALL				
GISL-20	*202207061-0020*	7/28/2022	8/15/2022	0.2798 g	0.049 % wt
	Site: 110-3 BEIGE CEILING				
GISL-21	*202207061-0021*	7/28/2022	8/17/2022	0.2507 g	0.074 % wt
	Site: STAFF DINING 105 BEIGE WALL				
GISL-22	*202207061-0022*	7/28/2022	8/15/2022	0.2898 g	0.10 % wt
	Site: CAFETERIA 104 BEIGE WALL				
GISL-23	*202207061-0023*	7/28/2022	8/15/2022	0.2798 g	0.015 % wt
	Site: HALLWAY BY 103 GRAY FLOOR				
GISL-24	*202207061-0024*	7/28/2022	8/15/2022	0.2913 g	0.34 % wt
	Site: HALLWAY BY 106 BEIGE WALL				
GISL-25	*202207061-0025*	7/28/2022	8/15/2022	0.2613 g	0.21 % wt
	Site: KITCHEN WHITE WALL				
GISL-26	*202207061-0026*	7/28/2022	8/15/2022	0.2563 g	0.35 % wt
	Site: HALLWAY BY 100				
GISL-27	*202207061-0027*	7/28/2022	8/15/2022	0.2855 g	0.19 % wt
	Site: BASEMENT BY BACK-STREET GRAY FLOOR				
GISL-28	*202207061-0028*	7/28/2022	8/15/2022	0.2801 g	<0.0080 % wt
	Site: BASEMENT BY BACK-STREET GREEN WALL				
GISL-29	*202207061-0029*	7/28/2022	8/15/2022	0.2701 g	0.31 % wt
	Site: BASEMENT BY BACK-STREET HALLWAY WHITE WALL				
GISL-30	*202207061-0030*	7/28/2022	8/15/2022	0.2580 g	0.20 % wt
	Site: BASEMENT BY BACK-STREET GRAY BASEBOARD				

Owen Mckenna, Lead Laboratory Director
or other approved signatory

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500 Horizon Drive
Suite 540
Robbinsville, NJ 08691

Phone:	(609) 890-7277
Fax:	(609) 890-9116
Received:	8/15/2022 10:00 AM
Collected:	7/28/2022

Project: **ROWAN - GIS**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Weight*	*Lead Concentration*
GISL-31	*202207061-0031*	7/28/2022	8/15/2022	0.2543 g	1.2 % wt
	Site: BASEMENT BY STREET WHITE DOOR				
GISL-32	*202207061-0032*	7/28/2022	8/15/2022	0.2988 g	2.1 % wt
	Site: BASEMENT BY STREET RED DOOR				

The MS recovery for Lead associated with sample -0024 was outside of the method control limits low.

Owen Mckenna, Lead Laboratory Director
or other approved signatory

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Initial report from 08/17/2022 16:32:52

OrderID: 042220643

Asbestos Chain of Custody

EMSL Order Number *(Lab Use Only)*: 042220643

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

EMSL ANALYTICAL, INC.
200 ROUTE 130 N
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5973

RECEIVED
EMSL
CINNAMINSON, NJ
22 AUG 18 AM 10:12

Company : PARS Environmental		**EMSL-Bill to:** ☒ Same ☐ Different If Bill to is Different note instructions in Comments** *Third Party Billing requires written authorization from third party*	
Street: 500 Horizon Drive, Suite 540			
City: Robbinsville	**State/Province: NJ**	**Zip/Postal Code: 08691**	**Country: USA**
Report To (Name): Julian Fernandez-Obregon		**Fax #: 609-890-9116**	
Telephone #: 609-890-7277		**Email Address: jfernandez@montrose-env.com**	
Project Name/Number: Rowan - GIS Roof			
Please Provide Results: ☐ Fax ☒ Email	**Purchase Order:** 1200-92	**U.S. State Samples Taken: NJ**	

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☑ 1 Week ☐ 2 Week

**For TEM Air 3 hr through 6 hr, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air
- ☐ NIOSH 7400
- ☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
- ☑ PLM EPA 600/R-93/116 (<1%)
- ☑ PLM EPA NOB (<1%)

Point Count
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)

Point Count w/Gravimetric
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- ☐ NYS 198.1 (friable in NY)
- ☐ NYS 198.6 NOB (non-friable-NY)
- ☐ NIOSH 9002 (<1%)

TEM – Air ☐ **4-4.5hr TAT (AHERA only)**
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312

TEM - Bulk
- ☑ TEM EPA NOB
- ☐ NYS NOB 198.4 (non-friable-NY)
- ☐ Chatfield SOP
- ☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2
- Fibers >10µm ☐ Waste ☐ Drinking
- All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
- ☐ Microvac - ASTM D 5755
- ☐ Wipe - ASTM D6480
- ☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
- ☐ PLM CARB 435 - A (0.25% sensitivity)
- ☐ PLM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - C (0.01% sensitivity)
- ☐ EPA Protocol (Semi-Quantitative)
- ☐ EPA Protocol (Quantitative)

Other:
- ☐

☑ **Check For Positive Stop – Clearly Identify Homogenous Group**

Samplers Name: Collin Oriente **Samplers Signature:** CO

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
	See Attached		

Client Sample # (s): - **Total # of Samples:** 51

Relinquished (Client): CO **Date:** 8/18/22 **Time:**

Received (Lab): CO WF **Date:** 8/18/22 **Time:** 10:10

Comments/Special Instructions: Only run one sample per Homogenous Area via TEM, if negative via PLM / PLM NOB, not all samples

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: CO Site Location Glassboro Intermediate School - 202 Delsea Dr N Page: 2

RECEIVED EMSL CINCINNATI OH 22 AUG 18 AM 10:12

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-1	Black Mats	GISR-1 GISR-2 GISR-3	Roof 1 Lower Right		D	
M-2	Silver roof liner paint	GISR-4 GISR-5 GISR-6	Roof 1 Lower Right		D	
M-3	Roof Core	GISR-7 GISR-14 GISR-27	Roof 1 lower Right, midde, and lower left		D	
M-4	HVAC Skirt	GISR-8 GISR-9 GISR-10	Roof 1 lower Right		G	
M-5	Tar	GISR-11 GISR-12 GISR-13	Roof 1 middle		D	
M-6	Metal pipe covering	GISR-15 GISR-16 GISR-17	Roof 1 middle		D	
M-7	Ledge Tar	GISR-18 GISR-19 GISR-20	Roof 1 middle		D	
M-8	Copper flashing and mastic	GISR-21 GISR-22 GISR-23	ROOF 1 Upper left		D	
M-9	Tar and Sealant	GISR-24 GISR-25 GISR-26	Roof 1 Upper left		D	
M-10	Black caulk	GISR-28 GISR-29 GISR-30	Roof 1 lower left		D	

Signature: [signature] Date Sampled: 8/17/22 PARS Project #: 1200-42

OrderID: 042220643

PARS Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: CO Site Location Glassboro Intermediate School - 203 Delsea Dr N Page: 3

RECEIVED EMSL CINNAMINSON NJ 22 AUG 18 AM 10:12

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-11	White Caulk	GISR-31 GISR-32 GISR-33	Roof 1 Lower Left		D	
M-12	White Caulk	GISR-34 GISR-35 GISR-36	Roof 2 Lower Right		D	
M-13	Black Caulk	GISR-37 GISR-38 GISR-39	Roof 2 Lower Right		D	
M-14	Roof Core	GISR-40 GISR-40A	Roof 2 Lower Right		D	
M-15	Black mastic	GISR-41 GISR-42 GISR-43	Roof 2 Upper Right		D	
M-16	Roof Core	GISR-44 GISR-48 GISR-51	Roof 2 Upper Right, upper left		D	
M-17	Black tar sealant	GISR-45 GISR-46 GISR-47	Roof 2 Upper left		D	
M-18	Roof core	GISR-49 GISR-50	Roof 3		D	

Signature: Date Sampled: 8/17/22 PARS Project #: 1200-42

Page 3 Of 3

OrderID: 042220643

EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Attn: Julian Fernandez-Obgegon
PARS Environmental
500 Horizon Drive
Suite 540
Robbinsville, NJ 08691

Phone:	(609) 890-7277
Fax:	(609) 890-9116
Collected:	
Received:	8/18/2022
Analyzed:	8/29/2022

Proj: Rowan - GIS Roof / Glassboro Later Mediatc School - 202 Delsea Dr. N. (Rowan University)

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-1 ***Lab Sample ID:*** **042220643-0001**
Sample Description: Roof 1 - Lower Right/Black Mats

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	White/Black	8.3%	91.7%	None Detected	
TEM Grav. Reduction	8/29/2022	White/Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-2 ***Lab Sample ID:*** **042220643-0002**
Sample Description: Roof 1 - Lower Right/Black Mats

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	White/Black	7.9%	92.1%	None Detected	

Client Sample ID: GISR-3 ***Lab Sample ID:*** **042220643-0003**
Sample Description: Roof 1 - Lower Right/Black Mats

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	White/Black	9.8%	90.2%	None Detected	

Client Sample ID: GISR-4 ***Lab Sample ID:*** **042220643-0004**
Sample Description: Roof 1 - Lower Right/Silver Roof Liner Paint

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black/Silver	0.89%	99.1%	None Detected	
TEM Grav. Reduction	8/29/2022	Black/Silver	0.0%	100.0%	None Detected	

Client Sample ID: GISR-5 ***Lab Sample ID:*** **042220643-0005**
Sample Description: Roof 1 - Lower Right/Silver Roof Liner Paint

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black/Silver	1.2%	98.8%	None Detected	

Client Sample ID: GISR-6 ***Lab Sample ID:*** **042220643-0006**
Sample Description: Roof 1 - Lower Right/Silver Roof Liner Paint

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black/Silver	0.0%	100%	None Detected	

Client Sample ID: GISR-7-Roofing ***Lab Sample ID:*** **042220643-0007**
Sample Description: Roof 1 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	11.2%	88.8%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

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EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-7-Tar **Lab Sample ID:** **042220643-0007A**

Sample Description: Roof 1 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-7-Tar Felt **Lab Sample ID:** **042220643-0007B**

Sample Description: Roof 1 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	4.1%	95.9%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-7-Tar Paper **Lab Sample ID:** **042220643-0007C**

Sample Description: Roof 1 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.58%	99.4%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-7-Insulation **Lab Sample ID:** **042220643-0007D**

Sample Description: Roof 1 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Gray	80.0%	20.0%	None Detected	

Client Sample ID: GISR-7-Foam **Lab Sample ID:** **042220643-0007E**

Sample Description: Roof 1 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: GISR-8 **Lab Sample ID:** **042220643-0008**

Sample Description: Roof 1 - Lower Right/HVAC Skirt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-9 **Lab Sample ID:** **042220643-0009**

Sample Description: Roof 1 - Lower Right/HVAC Skirt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	

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EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-10 ***Lab Sample ID:*** **042220643-0010**
Sample Description: Roof 1 - Lower Right/HVAC Skirt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-11 ***Lab Sample ID:*** **042220643-0011**
Sample Description: Roof 1 - Middle/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-12 ***Lab Sample ID:*** **042220643-0012**
Sample Description: Roof 1 - Middle/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-13 ***Lab Sample ID:*** **042220643-0013**
Sample Description: Roof 1 - Middle/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-14-Roofing ***Lab Sample ID:*** **042220643-0014**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	5.2%	94.8%	None Detected	

Client Sample ID: GISR-14-Tar ***Lab Sample ID:*** **042220643-0014A**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	5.9%	94.1%	None Detected	

Client Sample ID: GISR-14-Tar Felt ***Lab Sample ID:*** **042220643-0014B**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-14-Tar Paper ***Lab Sample ID:*** **042220643-0014C**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.36%	99.6%	None Detected	

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Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-14-Membrane **Lab Sample ID:** **042220643-0014D**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	7.5%	92.5%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-14-Insulation **Lab Sample ID:** **042220643-0014E**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Brown	90.0%	10.0%	None Detected	

Client Sample ID: GISR-14-Foam **Lab Sample ID:** **042220643-0014F**
Sample Description: Roof 1 - Middle/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Black/Yellow	20.0%	80.0%	None Detected	

Client Sample ID: GISR-15 **Lab Sample ID:** **042220643-0015**
Sample Description: Roof 1 - Middle/Metal Pipe Covering

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Silver	0.0%	100.0%	None Detected	
TEM Grav. Reduction	8/29/2022				Insufficient Residue	

Client Sample ID: GISR-16 **Lab Sample ID:** **042220643-0016**
Sample Description: Roof 1 - Middle/Metal Pipe Covering

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Silver	0.0%	100.0%	None Detected	

Client Sample ID: GISR-17 **Lab Sample ID:** **042220643-0017**
Sample Description: Roof 1 - Middle/Metal Pipe Covering

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Silver	0.0%	100.0%	None Detected	

Client Sample ID: GISR-18 **Lab Sample ID:** **042220643-0018**
Sample Description: Roof 1 - Middle/Ledge Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	97.0%	**3.0% Chrysotile**	

Client Sample ID: GISR-19 **Lab Sample ID:** **042220643-0019**
Sample Description: Roof 1 - Middle/Ledge Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-20 ***Lab Sample ID:*** **042220643-0020**
Sample Description: Roof 1 - Middle/Ledge Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-21-Flashing ***Lab Sample ID:*** **042220643-0021**
Sample Description: Roof 1 - Upper Left/Copper Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Gold/Orange	0.0%	100.0%	None Detected	
TEM Grav. Reduction	8/29/2022				Insufficient Residue	

Client Sample ID: GISR-21-Mastic ***Lab Sample ID:*** **042220643-0021A**
Sample Description: Roof 1 - Upper Left/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Green	0.0%	94.7%	**5.3% Chrysotile**	

Client Sample ID: GISR-22-Flashing ***Lab Sample ID:*** **042220643-0022**
Sample Description: Roof 1 - Upper Left/Copper Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Gold/Orange	0.0%	100.0%	None Detected	

Client Sample ID: GISR-22-Mastic ***Lab Sample ID:*** **042220643-0022A**
Sample Description: Roof 1 - Upper Left/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-23-Flashing ***Lab Sample ID:*** **042220643-0023**
Sample Description: Roof 1 - Upper Left/Copper Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Gold	0.0%	100.0%	None Detected	

Client Sample ID: GISR-23-Mastic ***Lab Sample ID:*** **042220643-0023A**
Sample Description: Roof 1 - Upper Left/Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Insufficient Material	

Client Sample ID: GISR-24-Tar ***Lab Sample ID:*** **042220643-0024**
Sample Description: Roof 1 - Upper Left/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	**<0.25% Chrysotile**	
TEM Grav. Reduction	8/29/2022	Black	0.00%	99.54%	**0.46% Chrysotile**	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-24-Sealant **Lab Sample ID:** **042220643-0024A**
Sample Description: Roof 1 - Upper Left/Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	91.8%	**8.2% Chrysotile**	

Client Sample ID: GISR-25-Tar **Lab Sample ID:** **042220643-0025**
Sample Description: Roof 1 - Upper Left/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	97.7%	**2.3% Chrysotile**	

Client Sample ID: GISR-26-Tar **Lab Sample ID:** **042220643-0026**
Sample Description: Roof 1 - Upper Left/Tar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-26-Sealant **Lab Sample ID:** **042220643-0026A**
Sample Description: Roof 1 - Upper Left/Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-27-Roofing **Lab Sample ID:** **042220643-0027**
Sample Description: Roof 1 - Lower Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	12.6%	87.4%	None Detected	

Client Sample ID: GISR-27-Tar **Lab Sample ID:** **042220643-0027A**
Sample Description: Roof 1 - Lower Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	1.2%	98.8%	None Detected	

Client Sample ID: GISR-27-Tar Felt **Lab Sample ID:** **042220643-0027B**
Sample Description: Roof 1 - Lower Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	4.3%	95.7%	None Detected	

Client Sample ID: GISR-27-Tar Paper **Lab Sample ID:** **042220643-0027C**
Sample Description: Roof 1 - Lower Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Brown	<0.25%	100%	None Detected	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-27-Insulation **Lab Sample ID:** **042220643-0027D**
Sample Description: Roof 1 - Lower Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Brown	0.0%	100.0%	None Detected	

Client Sample ID: GISR-27-Foam **Lab Sample ID:** **042220643-0027E**
Sample Description: Roof 1 - Lower Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Black/Yellow	25.0%	75.0%	None Detected	

Client Sample ID: GISR-28 **Lab Sample ID:** **042220643-0028**
Sample Description: Roof 1 - Lower Left/Black Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-29 **Lab Sample ID:** **042220643-0029**
Sample Description: Roof 1 - Lower Left/Black Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/25/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-30 **Lab Sample ID:** **042220643-0030**
Sample Description: Roof 1 - Lower Left/Black Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-31 **Lab Sample ID:** **042220643-0031**
Sample Description: Roof 1 - Lower Left/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	White	0.0%	97.2%	**2.8% Chrysotile**	

Client Sample ID: GISR-32 **Lab Sample ID:** **042220643-0032**
Sample Description: Roof 1 - Lower Left/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-33 **Lab Sample ID:** **042220643-0033**
Sample Description: Roof 1 - Lower Left/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-34 ***Lab Sample ID:*** **042220643-0034**
Sample Description: Roof 2 - Lower Right/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	White	0.0%	100%	None Detected	
TEM Grav. Reduction	8/29/2022	White	0.0%	100.0%	None Detected	

Client Sample ID: GISR-35 ***Lab Sample ID:*** **042220643-0035**
Sample Description: Roof 2 - Lower Right/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	White	0.0%	100%	None Detected	

Client Sample ID: GISR-36 ***Lab Sample ID:*** **042220643-0036**
Sample Description: Roof 2 - Lower Right/White Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	White	0.0%	100%	None Detected	

Client Sample ID: GISR-37 ***Lab Sample ID:*** **042220643-0037**
Sample Description: Roof 2 - Lower Right/Black Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	93.1%	**6.9% Chrysotile**	

Client Sample ID: GISR-38 ***Lab Sample ID:*** **042220643-0038**
Sample Description: Roof 2 - Lower Right/Black Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-39 ***Lab Sample ID:*** **042220643-0039**
Sample Description: Roof 2 - Lower Right/Black Caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-40-Roofing ***Lab Sample ID:*** **042220643-0040**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	10.8%	89.2%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-40-Tar ***Lab Sample ID:*** **042220643-0040A**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	<0.25%	100%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.00%	99.79%	**0.21% Chrysotile**	

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Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-40-Tar Felt **Lab Sample ID:** **042220643-0040B**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	3.3%	96.7%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-40-Insulation **Lab Sample ID:** **042220643-0040C**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Brown/Gray	18.0%	82.0%	None Detected	Result includes a small amount of inseparable attached material

Client Sample ID: GISR-40A-Roofing **Lab Sample ID:** **042220643-0041**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	9.1%	90.9%	None Detected	

Client Sample ID: GISR-40A-Tar **Lab Sample ID:** **042220643-0041A**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-40A-Tar Felt **Lab Sample ID:** **042220643-0041B**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	5.5%	94.5%	None Detected	

Client Sample ID: GISR-40A-Insulation **Lab Sample ID:** **042220643-0041C**
Sample Description: Roof 2 - Lower Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Gray	40.0%	60.0%	None Detected	

Client Sample ID: GISR-41 **Lab Sample ID:** **042220643-0042**
Sample Description: Roof 2 - Upper Right/Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	99.3%	**0.72% Chrysotile**	
TEM Grav. Reduction	8/29/2022	Black	0.0%	93.3%	**6.7% Chrysotile**	

Client Sample ID: GISR-42 **Lab Sample ID:** **042220643-0043**
Sample Description: Roof 2 - Upper Right/Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.0%	96.5%	**3.5% Chrysotile**	

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EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-43 ***Lab Sample ID:*** **042220643-0044**

Sample Description: Roof 2 - Upper Right/Black Mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022				Positive Stop (Not Analyzed)	

Client Sample ID: GISR-44-Roofing ***Lab Sample ID:*** **042220643-0045**

Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	7.8%	92.2%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	**<0.17% Chrysotile**	

Client Sample ID: GISR-44-Tar Felt ***Lab Sample ID:*** **042220643-0045A**

Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	3.0%	96.3%	**0.72% Chrysotile**	
TEM Grav. Reduction	8/29/2022	Black	0.0%	97.6%	**2.4% Chrysotile**	

Client Sample ID: GISR-44-Tar Paper ***Lab Sample ID:*** **042220643-0045B**

Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	98.9%	**1.1% Chrysotile**	

Client Sample ID: GISR-44-Tar ***Lab Sample ID:*** **042220643-0045C**

Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	100%	**<0.25% Chrysotile**	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	**<0.1% Chrysotile**	

Client Sample ID: GISR-44-Insulation ***Lab Sample ID:*** **042220643-0045D**

Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Brown/Gray/Black	90.0%	10.0%	None Detected	

Client Sample ID: GISR-45 ***Lab Sample ID:*** **042220643-0046**

Sample Description: Roof 2 - Upper Left/Black Tar Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	99.4%	**0.61% Chrysotile**	
TEM Grav. Reduction	8/29/2022	Black	0.0%	93.9%	**6.1% Chrysotile**	

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EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-46 ***Lab Sample ID:*** **042220643-0047**
Sample Description: Roof 2 - Upper Left/Black Tar Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022	Black	0.0%	97.3%	**2.7% Chrysotile**	

Client Sample ID: GISR-47 ***Lab Sample ID:*** **042220643-0048**
Sample Description: Roof 2 - Upper Left/Black Tar Sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/26/2022			Positive Stop (Not Analyzed)		

Client Sample ID: GISR-48-Roofing ***Lab Sample ID:*** **042220643-0049**
Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.0%	100%	None Detected	

Client Sample ID: GISR-48-Tar Felt ***Lab Sample ID:*** **042220643-0049A**
Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	1.1%	98.9%	None Detected	

Client Sample ID: GISR-48-Tar ***Lab Sample ID:*** **042220643-0049B**
Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	4.2%	95.8%	None Detected	

Client Sample ID: GISR-48-Insulation ***Lab Sample ID:*** **042220643-0049C**
Sample Description: Roof 2 - Upper Right/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Black	45.0%	55.0%	None Detected	

Client Sample ID: GISR-49-Roofing ***Lab Sample ID:*** **042220643-0050**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	White/Black	4.8%	95.2%	None Detected	
TEM Grav. Reduction	8/29/2022	White/Black	0.0%	100.0%	**<0.19% Chrysotile**	

Client Sample ID: GISR-49-Tar Felt ***Lab Sample ID:*** **042220643-0050A**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	3.9%	96.1%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

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EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-49-Tar **Lab Sample ID:** **042220643-0050B**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	1.2%	98.8%	None Detected	
TEM Grav. Reduction	8/29/2022	Black	0.0%	100.0%	None Detected	

Client Sample ID: GISR-50-Roofing **Lab Sample ID:** **042220643-0051**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	White/Black	8.5%	91.5%	None Detected	

Client Sample ID: GISR-50-Tar Felt **Lab Sample ID:** **042220643-0051A**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	8.6%	91.4%	None Detected	

Client Sample ID: GISR-50-Tar Paper **Lab Sample ID:** **042220643-0051B**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.0%	100%	**<0.1% Chrysotile**	

Client Sample ID: GISR-50-Tar **Lab Sample ID:** **042220643-0051C**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: GISR-50-Insulation **Lab Sample ID:** **042220643-0051D**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Brown	80.0%	20.0%	None Detected	

Client Sample ID: GISR-50-Foam **Lab Sample ID:** **042220643-0051E**
Sample Description: Roof 3/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/27/2022	Tan/Black/Yellow	15.0%	85.0%	None Detected	

Client Sample ID: GISR-51-Roofing **Lab Sample ID:** **042220643-0052**
Sample Description: Roof 2 - Upper Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.82%	99.2%	None Detected	

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EMSL Order ID:	042220643
Customer ID:	PARS51
Customer PO:	1200-42
Project ID:	Rowan University

Summary Test Report for Asbestos Analysis in Accordance with N.J.A.C. 8:60 and 12:120 via EPA 600/R-93/116

Client Sample ID: GISR-51-Tar **Lab Sample ID:** **042220643-0052A**

Sample Description: Roof 2 - Upper Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/27/2022	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: GISR-51-Insulation **Lab Sample ID:** **042220643-0052B**

Sample Description: Roof 2 - Upper Left/Roof Core

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/28/2022	Brown	80.0%	20.0%	None Detected	

Analyst(s):

Andrew Borsos	PLM (12) PLM Grav. Reduction (10)
Corinne Lunden	PLM Grav. Reduction (24)
Debbie Little	TEM Grav. Reduction (12)
Julianna Hosbach	PLM Grav. Reduction (30)
Sarah Kleinbrahm	PLM (7)
Seri Smith	TEM Grav. Reduction (11)

Reviewed and approved by:

Samantha Rundstrom, Laboratory Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. Estimation of uncertainty available upon request. This report is a summary of multiple methods of analysis, fully compliant reports are available upon request. A combination of PLM and TEM analysis may be necessary to ensure consistently reliable detection of asbestos. This report must not be used to claim product endorsement by NVLAP of any agency or the U.S. Government.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ PA ID# 68-00367, NVLAP Lab Code 101048-0

Initial report from: 08/29/202221:43:01

Appendix E

Lead in Construction Standard Summary

OSHA Lead in Construction Standard Summary

As outlined in the preamble to the U.S. Department of Labor OSHA Construction Standard for Lead (29 CFR 1926.62 Lead), the lead in construction standard is applicable to all occupational exposure to lead in all construction work in which lead in any amount is present in an occupationally related context.

Based on the detected levels of lead in paint, the OSHA Construction Standard for Lead (29 CFR 1926.62 Lead) is applicable to all construction work at this site since employees may be occupationally exposed to lead. OSHA has included within the regulatory text three lists of tasks, the performance of which in the presence of lead, trigger basic protective provisions prior to air lead monitoring:

Task-related Trigger-1
The OSHA regulation, section (d), part (2) "protection of employees during assessment of exposure," states that where lead containing coatings or paint is present and the affected components are to be demolished, manually scraped, manually sanded, treated with heat gun application and/or power tool cleaned with a dust collection system, that until the employer performs an employee exposure assessment and documents that the employee(s) performing the demolition/renovation is not exposed to lead in excess of 500 micrograms per cubic meter (ug/m^3), which is 10 times the Personal Exposure Limit (PEL), the employer shall treat the employee as if the employee were exposed to lead above the PEL, and not in excess of ten (10) times the PEL, and shall implement employee protective measures.

Task-related Trigger-2
The OSHA regulation, section (d), part (2) "protection of employees during assessment of exposure," states that where lead containing coatings or paint is present and the affected components are to be rivet busted, power tool cleaned without dust collection systems, cleanup activities where dry expendable abrasives are used, abrasive blasting enclosure movement or removal or using lead containing mortar (lead burning), that until the employer performs an employee exposure assessment and documents that the employee(s) performing the listed tasks is not exposed to lead in excess of 500 ug/m^3, the employer shall treat the employee as if the employee were exposed to lead in excess of 500 ug/m^3 and shall implement employee protective measures as outlined within the regulation. Where the employer does establish that the employee is exposed to levels of lead below 500 ug/m^3, the employer may provide the exposed employee with the appropriate respirator prescribed for use at such lower exposures, in accordance with the regulation.

Task-related Trigger-3
The OSHA regulation, section (d), part (2) "protection of employees during assessment of exposure," states that where lead containing coatings or paint is present and the affected components are to be abrasive blasted, welded, cut or torched), that until the employer performs an employee exposure assessment and documents that the employee(s) performing the listed tasks is not exposed to lead in excess of 2,500 ug/m^3 (50X PEL), the employer shall treat the employee as if the employee were exposed to lead in excess of 2,500 ug/m^3 and shall implement employee protective measures as outlined within the regulation. Where the employer does establish that the

employee is exposed to levels of lead below 2,500 ug/m^3, the employer may provide the exposed employee with the appropriate respirator prescribed for use at such lower exposures, in accordance with the regulation. Until the employer performs an employee exposure assessment and determines actual employee exposure, the employer shall provide the employee(s) with interim protection as follows:

a) Appropriate respiratory protection
b) Appropriate personal protective clothing
c) Change areas
d) Hand washing facilities
e) Biological Monitoring
f) Respiratory, Safety and Hazard Communication Training

Where the employer has previously monitored for lead exposures, and the data was obtained within the past 12 months during work operations conducted under workplace conditions closely resembling the process, type of material, control methods, work practices, and environmental conditions used and prevailing in the employee's current operations, the employer may rely on such earlier monitoring results to satisfy the requirements of the regulation if the sampling and analytical methods meet the accuracy and confidence levels of the regulation.

The employer of construction workers is responsible for the development and implementation of a worker protection program in accordance with 29 CFR 1926.20 and 29 CFR 1926.62 (e). To implement the worker protection program properly, the employer needs to designate a competent person, i.e., one who is capable of identifying existing and predictable hazards or working conditions which are hazardous or dangerous to employees, in accordance with the general safety and health provisions of OSHA's construction standards.

At the minimum, the following elements should be included in the employer's worker protection program for employees exposed to lead:

- Hazard determination, including exposure assessment
- Engineering and work practice controls
- Respiratory protection
- Protective clothing and equipment
- Housekeeping
- Hygiene facilities and practices
- Medical surveillance and provisions for medical removal
- Training
- Signs; and
- Recordkeeping

It is OSHA policy that respirators are not to be used in lieu of engineering and work practices to reduce employee exposures to below the PEL. Respirators can only be used in combination with engineering controls and work practices to control employee exposures. This report is for planning purposes only. This report should not be used as the sole document for lead related activities.

Root A Anything 1% or over is Asbestos Containing

GIS

[redacted]

Core 9	Root A	TAR felt	0.25%
Core 9	Root A	TAR Paper	0.25%
Core 9	Root A	Roofing	0.25%
Core 10	Root A	Roofing	0.26%
Core 11	Root A	Membrane	0.25%
Core 11	Root A	TAR felt	0.25%
Core 11	Root A	TAR	0.25%
Core 11	Root A	Roofing	0.38%
Core 12	Root A	Membrane	0.25%
Core 12	Root A	Membrane 2	0.58%
Core 12	Root A	TAR Paper	19.1%
Core 12	Root A	Roofing	4.8%
Core 13	Root A	Roofing	0.25%
Core 16	Root A	Shingle	0.31%

Roof B Anything 1% or Over is Asbestos containing

GIS

Core 3 Roof B TAR 0.25%

Core 4 Roof B Mastic 0.47%

Core 7 Roof B Shingle 0.25%

Core 7 Roof B Membrane 0.25%

Core 7 Roof B TAR felt 0.25%

Core 7 Roof B TAR 0.25%

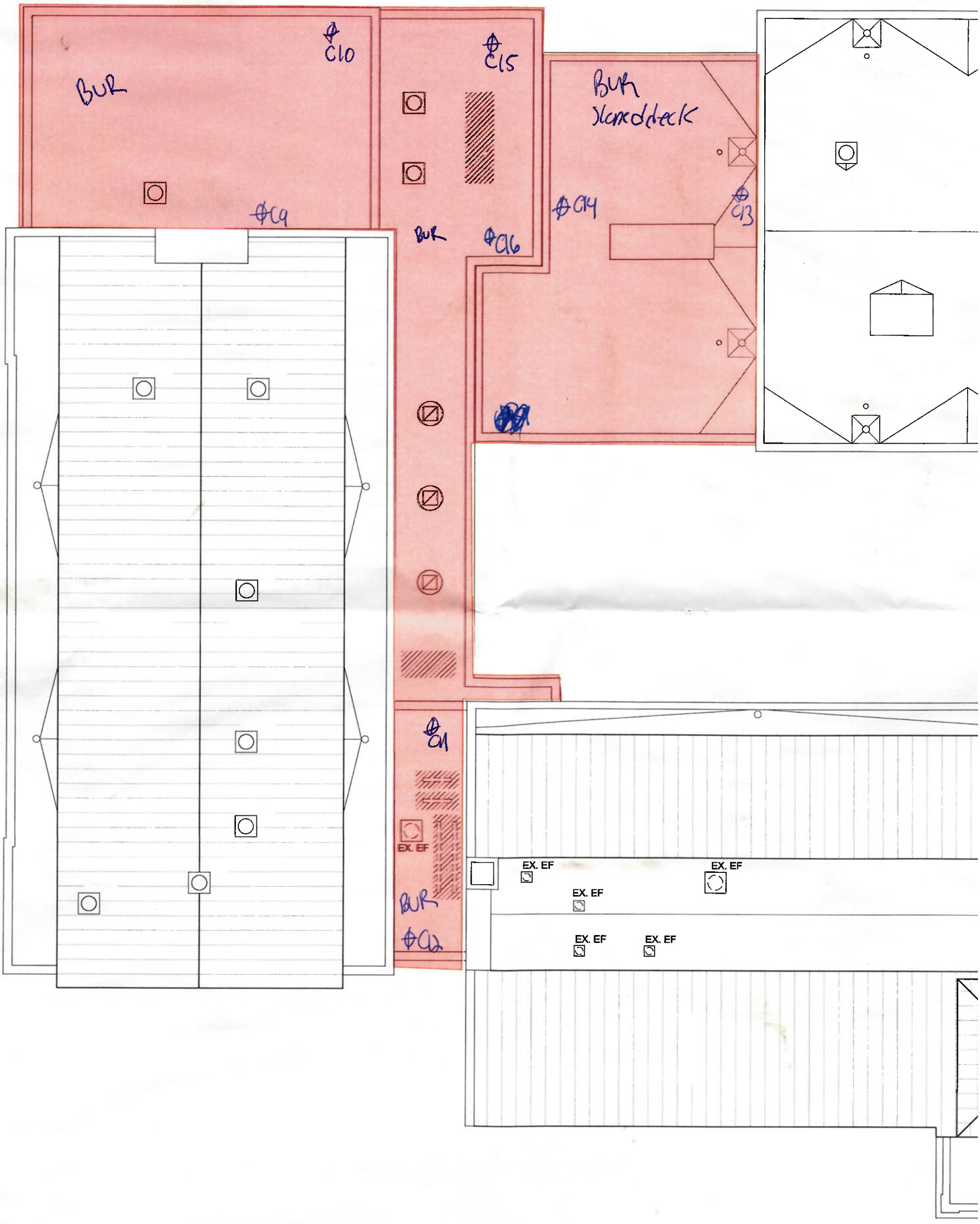
Core 8 Roof B Membrane 0.29%

Core 8 Roof B flashing 0.29%

Core 8 Roof B TAR Felt 0.25%

Core 8 Roof B Roofing 6.7%

Roof Area 'A'
3,515 SF

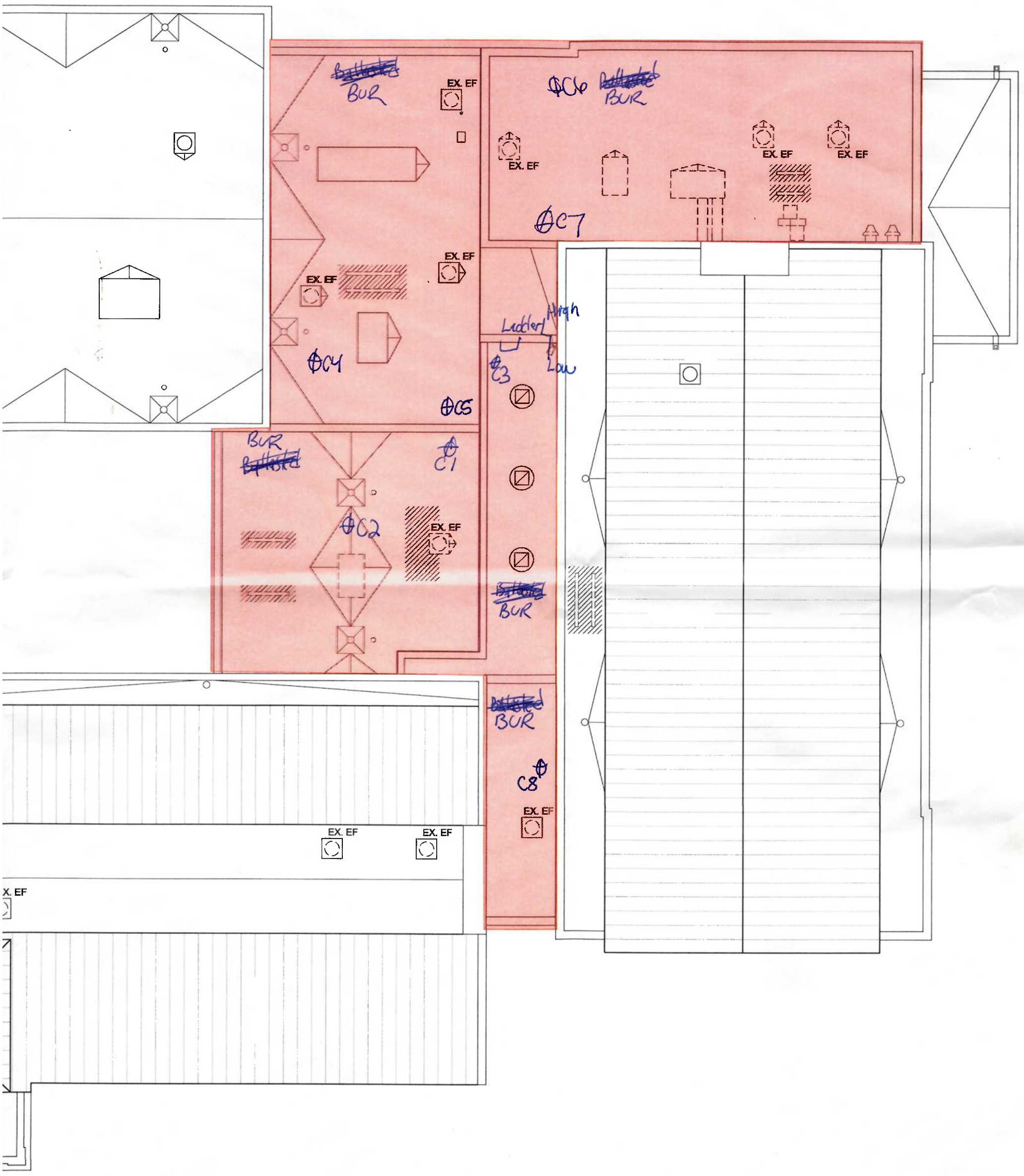


ROOF CORE LOCATIONS

ROWAN GLASSBORO INTERMEDIATE SCHOOL
EDGE TO EDGE ROOF SURVEY AREAS WITH PHOTOS
202 DELSEA DRIVE, GLASSBORO, NJ 08028
MARCH 4, 2025

40 S Stoke St
Sverne Hall

Roof Area 'B'
4,393 SF



MONTROSE ENVIRONMENTAL

Report

November 13, 2025

Thomas Gallia
Rowan University
Facilities Operations
Environmental Health & Safety
201 Mullica Hill Road
Glassboro, New Jersey 08028

RE: **Glassboro Intermediate School Entrance ACM Sampling**
Pre-Renovation Sampling
Montrose Project Number 1200-94

Dear Mr. Gallia:

Montrose Environmental Solutions, Inc. (Montrose) is pleased to provide this letter report to Rowan University (Rowan) concerning asbestos-containing materials (ACM) testing of specific materials within the front entrance of the previous Glassboro Intermediate School located at 202 N Delsea Dr, Glassboro, New Jersey, (Site). Rowan plans to renovate the front entrance and may impact presumed asbestos-containing materials.

Background

The United States Environmental Protection Agency (USEPA) defines asbestos-containing materials (ACM) as a material that contains greater than one percent (>1%) asbestos. The National Emission Standard for Hazardous Air Pollutants (NESHAP) defines a Regulated Asbestos-Containing Material (RACM) as any friable manufactured ACM containing >1% asbestos using PLM, which can be crumbled, pulverized, or reduced to a powder by hand pressure when dry, or a Category I non-friable ACM that has become friable, or a Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces to act on a material in the course of demolition or renovation activities. Materials that contain less than 1% asbestos are not considered ACM, and not regulated by the USEPA.

Discussion

Mr. Joshua Allen, an accredited Asbestos Hazardous Emergency Response Act (AHERA) Inspector from Montrose, inspected the areas and identified 3 separate types of materials, with 9 total samples collected from the property:

- M-1 Grey Front Door Caulking – Exterior Front Entrance
- M-2 White Front Door Trim Caulking – Exterior Front Entrance
- M-3 Interior Front Door Caulking – Interior Front Entrance

Montrose placed bulk samples inside 4-mil plastic bags which were sealed for transport for analysis by EMSL Analytical, Inc. (EMSL) a National Institute of Standards and Technology National Voluntary Laboratory Accreditation Program (NIST-NVLAP) certified laboratory (#101048-0), on a one-week turnaround time.

Bulk samples were analyzed using United States Environmental Protection Agency (EPA) Method 600/R-93/116 Polarized Light Microscopy with dispersion staining (PLM) analysis. Bulk samples were analyzed using a "positive stop" protocol. Positive stop is a process where if a sample from a homogeneous area is determined by the laboratory to contain greater than 1% asbestos, no additional samples from that homogeneous area will be analyzed.

Non-friable materials that were negative via PLM were also submitted for analysis via Transmission Electron Microscopy (TEM), as necessary, per NJ State requirements. Non-friable organically bound (NOB) matrices include materials such as floor tiles, mastic, cove base/molding, glues, roofing materials, etc.

Results

Asbestos was identified in the exterior white trim caulking within the areas to be disturbed within Glassboro Intermediate School. One sample contained 1.5% Chrysotile, exceeding the definition of asbestos containing material (greater than 1%). Representative photos of materials sampled are provided in **Attachment A**. Inspector and Laboratory certifications are provided in **Attachment B**. All laboratory reports are provided in **Attachment C.**

Conclusion

ACM is present within the exterior trim caulking of Glassboro Intermediate School Front Entrance. The caulking must be abated prior to any renovation actions that may disturb this material. We appreciate the opportunity to support Rowan University with this project. If you have any questions or require additional information, please contact me at 609-890-7277 / jfernandez@montrose-env.com.

Very truly yours,
Montrose Environmental Solutions, Inc.

Joshua Allen
Staff Health & Safety Specialist

Julian Fernandez-Obregon
Director, Health & Safety Services
Senior Health & Safety Specialist

Attachments:

Attachment A – Representative Photos
Attachment B – Inspector / Laboratory Certifications
Attachment C – Laboratory Report

Attachment A

Representative Photos

Attachment A
Representative Photos
Glassboro Intermediate School Front Entrance ACM Sampling
Rowan University

Photo 1. M-1 Grey Front Door Caulking – Exterior Front Entrance

Photo 2. M-2 White Front Door Trim Caulking – Exterior Front Entrance

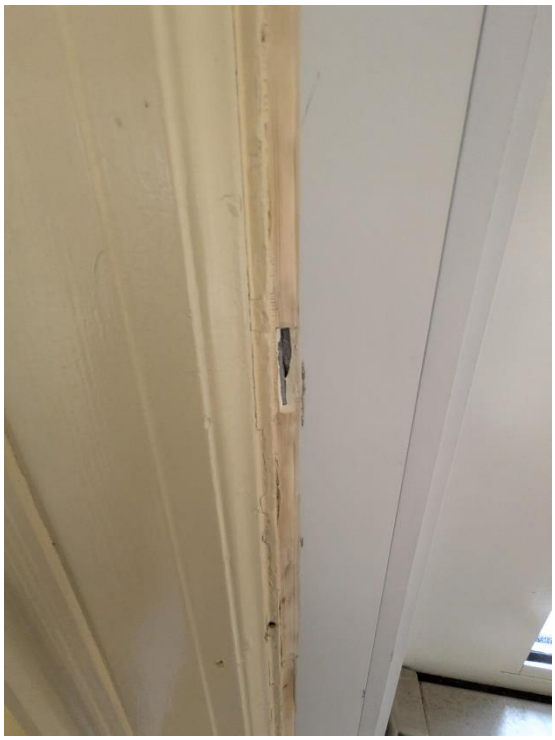


Photo 3. M-3 Interior Front Door Caulking – Interior Front Entrance

Attachment B

Inspector / Laboratory Certifications

STATE OF NEW YORK - DEPARTMENT OF LABOR
ASBESTOS CERTIFICATE

N.Y.S

JOSHUA ALLEN
CLASS(EXPIRES)
D INSP (03/26)

CERT# 24-631Z4-SHAB
DMV# 745827496

MUST BE CARRIED ON ASBESTOS PROJECTS

NAETI

66474

CERTIFICATE OF COMPLETION

AHERA/EPA Accredited Per 40 CFR Part 763
Asbestos Accreditation under TSCA Title II

Julian Fernandez

Successfully completed the course entitled

1/2-Day New York State/EPA/AHERA Asbestos Building Inspector Annual Refresher on November 5th, 2024

Examination Date on November 5th, 2024 *Expiration Date on November 5th, 2025*

Glenn Neuschwender, Greg Krueger
Training Directors, NAETI

Per 10 NYCRR Part 73.2 (L) (1), DOH 2832 Certificate of Completion of Asbestos Safety Training is the only official record of training for N.Y.S. students.

Language: English

ABIH 1/2 CM POINT

106 Apple St. Suite 112B Tinton Falls, NJ 07724 Phone (732) 531-5571 www.naeti.com

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077

Laboratory ID: LAP-100194

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs, LLC (AIHA LAP) accreditation to the ISO/IEC 17025:2017 international standard, General Requirements for the Competence of Testing and Calibration Laboratories in the following:

LABORATORY ACCREDITATION PROGRAMS

☑	**INDUSTRIAL HYGIENE**	Accreditation Expires: April 01, 2027
☑	**ENVIRONMENTAL LEAD**	Accreditation Expires: April 01, 2027
☑	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: April 01, 2027
☐	**FOOD**	Accreditation Expires:
☐	**UNIQUE SCOPES**	Accreditation Expires:
☐	**BE FIELD/MOBILE**	Accreditation Expires:

Specific Field(s) of Testing/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached Scope of Accreditation. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2017 and AIHA LAP requirements. This certificate is not valid without the attached Scope of Accreditation. Please review the AIHA LAP website (www.aihaaccreditedlabs.org) for the most current Scope.

Cheryl O Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision21: 10/24/2023

Date Issued: 05/01/2025

AIHA Laboratory Accreditation Programs, LLC

SCOPE OF ACCREDITATION

EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077

Laboratory ID: LAP-100194

Issue Date: 08/05/2024
Expire Date: 04/01/2027

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 02/01/1989

IHLAP Scope Category	Field of Testing (FOT)	Technology sub-type/Detector	Published Reference Method/Title of In-house Method	Component, parameter, characteristic, material, or product tested
Asbestos/Fiber Microscopy Core	Phase Contrast Microscopy (PCM)	-	NIOSH 7400	Asbestos/Fibers
Asbestos/Fiber Microscopy Core	Polarized Light Microscopy (PLM)	-	EPA 600/R-93/116	Asbestos & Other Fibers in Bulk
Asbestos/Fiber Microscopy Core	Transmission Electron Microscopy (TEM)	-	EPA AHERA - 40 CFR Part 763	Asbestos
Asbestos/Fiber Microscopy Core	Transmission Electron Microscopy (TEM)	-	NIOSH 7402	Asbestos/Fibers
Chromatography Core	Gas Chromatography	Diffusive Sampler	NIOSH 1501	Aromatic Hydrocarbons
Chromatography Core	Gas Chromatography	GC/ECD	NIOSH 5503 Modified	Polychlorinated biphenyls
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1003 Modified	Halogenated Hydrocarbons
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1005 Modified	Methylene Chloride
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1400 Modified	Alcohols
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1500 Modified	Hydrocarbons
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1501 Modified	Aromatic Hydrocarbons
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1550 Modified	Total Petroleum Hydrocarbons
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 1603 Modified	Acetic Acid
Chromatography Core	Gas Chromatography	GC/FID	NIOSH 2000 Modified	Methyl Alcohol
Chromatography Core	Gas Chromatography	GC/MS	EPA TO-15	Volatile Organic Compounds
Chromatography Core	Ion Chromatography (IC)	-	NIOSH 6004 Modified	Sulfur Dioxide/Sulfate

AIHA LAP™

IHLAP Scope Category	Field of Testing (FOT)	Technology sub-type/Detector	Published Reference Method/Title of In-house Method	Component, parameter, characteristic, material, or product tested
Chromatography Core	Ion Chromatography (IC)	-	NIOSH 6011	Chlorine & Bromine
Chromatography Core	Ion Chromatography (IC)	-	NIOSH 7903	Inorganic Acids
Chromatography Core	Ion Chromatography (IC)	-	OSHA ID-214	Ozone
Chromatography Core	Liquid Chromatography	HPLC/FL	NIOSH 2016	Formaldehyde
Chromatography Core	Liquid Chromatography	HPLC/UV	NIOSH 5506 Modified	Polynuclear Aromatic Hydrocarbons (PAHs)
Chromatography Core	Liquid Chromatography	LC/MS	NIOSH 9111 Modified	Methamphetamines
Miscellaneous Core	Gravimetric	-	NIOSH 0500	Total Dust
Miscellaneous Core	Gravimetric	-	NIOSH 0600	Respirable Dust
Miscellaneous Core	Gravimetric	-	NIOSH 5524	Metal Working Fluids
Miscellaneous Core	Thermo-optical Analysis (TOA)	-	NIOSH 5040	Elemental Carbon
Spectrometry Core	Atomic Absorption	CVAA	NIOSH 6009 Modified	Mercury
Spectrometry Core	Atomic Absorption	CVAA	OSHA ID-140 Modified	Mercury vapor
Spectrometry Core	Atomic Absorption	CVAA	OSHA ID-145	Mercury particulate
Spectrometry Core	Atomic Absorption	FAA	NIOSH 7082	Lead
Spectrometry Core	Inductively-Coupled Plasma	ICP/AES	NIOSH 7300 Modified	Lead
Spectrometry Core	Inductively-Coupled Plasma	ICP/MS	NIOSH 7300 Modified	Lead
Spectrometry Core	X-ray Diffraction (XRD)	-	NIOSH 7500	Silica
Spectrometry Core	X-ray Diffraction (XRD)	-	OSHA ID-142	Silica

A complete listing of currently accredited IHLAP laboratories is available on the AIHA LAP, LLC website at: *http://www.aihaaccreditedlabs.org*

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 101048-0

EMSL Analytical, Inc.

Cinnaminson, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Asbestos Fiber Analysis

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique on ISO/IEC 17025).

2025-07-01 through 2026-06-30

Effective Dates

For the National Voluntary Laboratory Accreditation Program

National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Ms. Samantha Rundstrom
Phone: 856-303-2577
Email: srundstrom@emsl.com
http://www.emsl.com

ASBESTOS FIBER ANALYSIS **NVLAP LAB CODE 101048-0**

Bulk Asbestos Analysis

Code	*Description*
18/A01	EPA -- 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples
18/A03	EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials

Airborne Asbestos Analysis

Code	*Description*
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

For the National Voluntary Laboratory Accreditation Program

Attachment C

Laboratory Reports

OrderID: 042521909

EMSL ANALYTICAL, INC.
TESTING LABS • PRODUCTS • TRAINING

Asbestos Chain of Custody (Air, Bulk, Soil)

EMSL Order Number / Lab Use Only: 042521909

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
PHONE: (800) 220-3675
EMAIL: CinnAslab@EMSL.com

If Bill-To is the same as Report-To leave this section blank. Third-party billing requires written authorization.

Customer Information

Customer ID:	PARS51
Company Name:	Montrose Environmental
Contact Name:	Julian Fernandez-Obregon
Street Address:	500 Horizon Drive, Suite 540
City, State, Zip:	Robbinsville
Country:	USA
Phone:	609-890-7277
Email(s) for Report:	jfernandez@montrose-env.com

Billing Information

Billing ID:	
Company Name:	
Billing Contact:	
Street Address:	
City, State, Zip:	
Country:	
Phone:	
Email(s) for Invoice:	

Project Information

Project Name/No:	Rowan University - GIS Sampling
Purchase Order:	1200-94
EMSL LIMS Project ID: (If applicable, EMSL will provide)	
US State where samples collected:	NJ
State of Connecticut (CT) must select project location:	☐ Commercial (Taxable) ☐ Residential (Non-Taxable)
Sampled By Name:	Joshua Allen
Sampled By Signature:	
No. of Samples in Shipment	9

Turn-Around-Time (TAT)

☐ 3 Hour ☐ 4-4.5 Hour AHERA ONLY ☐ 6 Hour ☐ 24 Hour ☐ 32 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☑ 1 Week ☐ 2 Week

TEM Air 3-6 Hour, please call ahead to schedule. 32 Hour TAT available for select tests only; samples must be submitted by 11:30 am.

Test Selection

PCM Air
- ☐ NIOSH 7400
- ☐ NIOSH 7400 w/ 8hr. TWA

PLM - Bulk (reporting limit)
- ☒ PLM EPA 600/R-93/116 (<1%)
- ☒ PLM EPA NOB (<1%)
- ☐ POINT COUNT
  - ☐ 400 (<0.25%) ☐ 1,000 (<0.1%)
- POINT COUNT w/ GRAVIMETRIC
  - ☐ 400 (<0.25%) ☐ 1,000 (<0.1%)
- ☐ NIOSH 9002 (<1%)
- ☐ NYS 198.1 (Friable - NY)
- ☐ NYS 198.6 NOB (Non-Friable - NY)
- ☐ NYS 198.8 (Vermiculite SM-V)

TEM - Air
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312*

TEM - Bulk
- ☒ TEM EPA NOB
- ☐ NYS NOB 198.4 (Non-Friable-NY)
- ☐ TEM EPA 600/R-93/116 w Milling Prep (0.1%)

Other Test (please specify)

TEM - Settled Dust
- ☐ Microvac - ASTM D5755
- ☐ Wipe - ASTM D6480
- ☐ Qualitative via Filtration Prep
- ☐ Qualitative via Drop Mount Prep

Soil - Rock - Vermiculite (reporting limit)*
- ☐ PLM EPA 600/R-93/116 with milling prep (<0.25%)
- ☐ PLM EPA 600/R-93/116 with milling prep (<0.1%)
- ☐ TEM EPA 600/R-93/116 with milling prep (<0.1%)
- ☐ TEM Qualitative via Filtration Prep
- ☐ TEM Qualitative via Drop Mount Prep

*Please call with your project-specific requirements.

☒ Positive Stop - Clearly Identified Homogeneous Areas (HA) | Filter Pore Size (Air Samples) ☐ 0.8um ☐ 0.45um

Sample Number	Sample Location / Description	Volume, Area or Homogeneous Area	Date / Time Sampled (Air Monitoring Only)
	See Attached COC		

RECEIVED EMSL CINNAMINSON, N.J. 2025 NOV -3 P 6:18

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

Method of Shipment:		Sample Condition Upon Receipt:	
Relinquished by:	Date/Time: 11/3/25	Received by: Kestrell T. DB	Date/Time: 11/03/25 6:20pm
Relinquished by:	Date/Time:	Received by:	Date/Time

Controlled Document - COC-05 Asbestos R16 10/26/2021

☐ AGREE TO ELECTRONIC SIGNATURE (By checking, I consent to signing this Chain of Custody document by electronic signature.)

EMSL Analytical, Inc.'s Laboratory Terms and Conditions are incorporated into this Chain of Custody by reference in their entirety. Submission of samples to EMSL Analytical, Inc. constitutes acceptance and acknowledgment of all terms and conditions by Customer.

9 DT

Page 1 of

OL12521909

Montrose Environmental, Inc. **500 Horizon Drive Suite 540 Robbinsville, New Jersey 08691**

Sampling Technician: Joshua Allen Site Location 202 Delsea Dr Glassboro, NJ 08028 Page: ____

HA No.	Material Type	ID	Sample Location	SF / LF	Condition G/D/SD	Notes
M-1	Exterior Front Door Caulking	GIS-01, 02, 03	Exterior Front Entrance	25 LF	SD	Grey caulking
M-2	Exterior Front Door Trim Caulking	GIS-04, 05, 06	Exterior Front Entrance	40 LF	SD	White Caulking around decorative trim
M-3	Interior Front Door Caulking	GIS-07, 08, 09	Interior Front Entrance	25 LF	G	

RECEIVED EMSI CINNAMINSON, N.J. 2025 NOV -3 P 6:18

Signature: _____ Date Sampled: 11/3/25 Project #: 1200-94

OrderID: 042521909

EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order ID:	042521909
Customer ID:	PARS51
Customer PO:	1200-94
Project ID:	Rowan University

Attn: Julian Fernandez
Montrose Environmental Solutions
500 Horizon Drive
Suite 540
Robbinsville, NJ 08691

Phone:	(609) 890-7277
Fax:	(609) 890-9116
Collected:	
Received:	11/03/2025
Analyzed:	11/10/2025

Proj: Rowan University-GIS Sampling / 202 Delsea Dr. Glassboro, NJ 08028 (Rowan University)

Summary Test Report for Asbestos Analysis of Bulk Materials in Accordance with N.J.A.C. 8:60 and 12:120

Client Sample ID: GIS-01 ***Lab Sample ID:*** **042521909-0001**
Sample Description: Exterior Front Entrance/Front Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	11/10/2025	Gray/White	0.0%	100%	None Detected	
TEM Grav. Reduction	11/10/2025	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-02 ***Lab Sample ID:*** **042521909-0002**
Sample Description: Exterior Front Entrance/Front Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	11/10/2025	Gray/White	0.0%	100%	None Detected	
TEM Grav. Reduction	11/10/2025	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-03 ***Lab Sample ID:*** **042521909-0003**
Sample Description: Exterior Front Entrance/Front Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	11/10/2025	Gray/White	0.0%	100%	None Detected	
TEM Grav. Reduction	11/10/2025	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-04 ***Lab Sample ID:*** **042521909-0004**
Sample Description: Exterior Front Entrance/Front Door Trim Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	11/10/2025	Gray/White	0.0%	100%	None Detected	

Client Sample ID: GIS-05 ***Lab Sample ID:*** **042521909-0005**
Sample Description: Exterior Front Entrance/Front Door Trim Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	11/10/2025	White	0.0%	100%	None Detected	

Client Sample ID: GIS-06 ***Lab Sample ID:*** **042521909-0006**
Sample Description: Exterior Front Entrance/Front Door Trim Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	11/10/2025	White	0.0%	98.5%	**1.5% Chrysotile**	

EMSL Analytical, Inc.

200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order ID:	042521909
Customer ID:	PARS51
Customer PO:	1200-94
Project ID:	Rowan University

Summary Test Report for Asbestos Analysis of Bulk Materials in Accordance with N.J.A.C. 8:60 and 12:120

Client Sample ID: GIS-07 ***Lab Sample ID:*** **042521909-0007**

Sample Description: Interior Front Entrance/Front Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	11/10/2025	Tan/White	0.0%	100%	None Detected	
TEM Grav. Reduction	11/10/2025	Tan/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-08 ***Lab Sample ID:*** **042521909-0008**

Sample Description: Interior Front Entrance/Front Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	11/10/2025	Tan/White	0.0%	100%	None Detected	
TEM Grav. Reduction	11/10/2025	Tan/White	0.0%	100.0%	None Detected	

Client Sample ID: GIS-09 ***Lab Sample ID:*** **042521909-0009**

Sample Description: Interior Front Entrance/Front Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	11/10/2025	White	0.0%	100%	None Detected	
TEM Grav. Reduction	11/10/2025	White	0.0%	100.0%	None Detected	

Analyst(s):

Adam Einwechter	PLM Grav. Reduction (6)
Hunter Kelly	PLM Grav. Reduction (3)
Julianna Hosbach	TEM Grav. Reduction (6)

Reviewed and approved by:

Samantha Sweeney, Laboratory Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This is a summary report; official reports are available on LabConnect or upon request and relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ PA ID# 68-00367, NVLAP Lab Code 101048-0

Initial report from: 11/10/202523:18:17

ASBESTOS ABATEMENT & LBP WORK PLAN

Glassboro Intermediate School
202 Delsea Drive
Glassboro, New Jersey 08028

PREPARED FOR:
Rowan University
201 Mullica Hill Road
Glassboro, New Jersey 08028

PREPARED BY:
Montrose Environmental
500 Horizon Drive, Suite 540
Robbinsville, New Jersey 08691

Montrose Project Number 1200-97

MONTROSE ENVIRONMENTAL

December 2025

Prepared/
Approved By: _____ 12/4/2025
Julian Fernandez-Obregon Date
Project Manager
AHERA Project Designer
Certification #251113-01

Revisions:

Revision 1. Date: _____ Amended By: _____

Revision 2. Date: _____ Amended By: _____

Revision 3. Date: _____ Amended By: _____

Revision 4. Date: _____ Amended By: _____

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Appendix A: Proposed Work Area Plan

1.0 PURPOSE

The purpose of this project is to safely remove asbestos-containing materials (ACM) caulking on the exterior entryway, and lead-based paint (LBP) throughout the former Glassboro Intermediate School (GIS) in order to prevent the release of friable asbestos fibers. Removal of the identified ACM will be performed in accordance to local, state, and federal regulations regarding asbestos removal, transportation, and disposal. This project will recognize and take all reasonable precautions against the documented biological and occupational dangers of airborne asbestos fibers. The work will be performed in manner that poses no immediate or long-term danger or health threat to the contractor workers and the occupants. A detailed breakdown of the of the project work area for the ACM abatement is presented in **Appendix A**.

LBP was identified throughout the Site, on original components, which included various door components, plaster and brick walls, stairwell components, window components, and wall trim. Lead-safe work practices and worker/occupant protection practices complying with current USEPA and Occupational Safety and Health Administration (OSHA) standards will be necessary to safely complete all work involving the disturbance of LBP coated surfaces and components.

It should be noted that all lead hazard control activities have the potential of creating additional hazards or even creating hazards that were not present before. All persons and/or firms performing lead hazard control activities must have received proper training in Lead-Safe Work Practices and/or Lead Abatement. Details for the listed lead hazard control options and issues surrounding occupant/worker protection practices can be found in the publication titled: *Guidelines for the Evaluation and Control of LBP Hazards in Housing (Second Edition, July 2012)* (HUD Guidelines), published by HUD, as well as in the OSHA regulations found in 29 CPR, Part 1926.62, known as the OSHA Lead Exposure in Construction Industry Standard.

2.0 ASBESTOS SCOPE OF WORK

Work consists of the removal and disposal of asbestos-containing materials (ACM) listed in the table below. It is the responsibility of the Asbestos Abatement Contractor (AAC), to identify and remove all of the ACM from the locations listed in the tables below.

Glassboro Intermediate School			
Material	**Location**	**Estimated Quantities**	**Type of Asbestos**
Entryway Caulking	Exterior Front Entryway	40 LF	1.5% Chrysotile

All removal activities will take place from the exterior environment, with the interior sealed with a limited tent containment, preventing any contamination into the building.

2.1 SPECIAL CONDITIONS

A. The AAC shall be responsible for the full compliance of all required governmental regulations in all aspects of these projects for which they are responsible to perform.

B. All ACM will be disposed of at a New Jersey Department of Environmental Protection (NJDEP) landfill, as specified in NJAC 7:26 and 40 CFR Part 61, Subpart M.

C. No decontamination unit is required, as the abatement is occurring outside of the building.

D. Amounts of material that are provided as part of these specifications are estimates only. The AAC is responsible for determining exact quantities.

E. The AAC is responsible for supplying all materials and labor for non-asbestos work (i.e. plumbing, electrical, carpentry, demolition) that are related to this asbestos abatement project.

F. Re-installation of new materials is not required as part of the project scope of work, although a temporary covering, including plywood, poly sheeting, and caulked seams for weatherproofing is required, as appropriate.

G. The AAC is responsible for making all the required Municipal, State, and Federal notifications for the projects and obtaining the construction permits, and certificates of occupancy.

H. The AAC is responsible for sealing the interior spaces from contamination with a layer of polyethylene sheeting on the interior of each doorway at the work area. This shall be comprised of two layers of sheeting, caulked at the seams. See

Appendix A for locations.

I. Abatement is to be conducted by removing the caulking via wet-scraping from the exterior.

J. The AAC shall supply a securable waste container in which all the packaged asbestos-containing waste (ACW) will be stored prior to transport. The location of the waste container shall be located as depicted in **Appendix A**.

K. It is recommended that the AAC document and photograph all existing damage in and adjacent to the work areas prior to starting any activities.

L. All electrical power to the work areas shall be protected by ground fault circuit interrupters (GFCIs) located outside of the work area.

M. The water sources for each work area shall be located outside of the work areas.

N. The AAC is responsible for Occupational Safety and Health Administration (OSHA) personal air monitoring according to 29 Code of Federal Regulations (CFR) 1926.1101. OSHA samples shall be collected and analyzed using the National Institute for Occupational Safety and Health (NIOSH) 7400 method by an OSHA-defined competent person. The time-weighted average (TWA) results must be received within 24 hours and must be posted at the job site.

O. All license and patent requirements are the sole responsibility of the AAC. Montrose and Rowan shall not be held accountable for any patent infringements made by the AAC.

P. The AAC must protect workers according to OSHA regulations, including 29 CFR 1910.134 and 29 CFR 1926.1101.

Q. The AAC must satisfy the Client's insurance requirements.

R. The AAC must fulfill all requirements of United States Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollutants (NESHAP) 40 CFR 763.61 Subpart M.

S. Asbestos waste containers must be labeled as required by OSHA (29 CFR 1926.1101 [K] [2] [iii]).

T. Asbestos removal must comply with all applicable Federal, State, and Municipal regulations, codes and ordinances including but not limited to the following:

- USEPA AHERA/ASHARA 40 CFR 763
- USEPA NATIONAL EMISSION STANDARD FOR HAZARDOUS AIR

POLUTANTS – (ASBESTOS 40 CFR 61 SUBPART M)
- NJ DLWD ASBESTOS LICENSING ACT NJAC 12:120
- NJ DEP DISPOSAL REGULATION NJAC 7:26
- OSHA 29 CFR 1926.1101

U. The AAC shall protect all surfaces within each work area as per 29 CFR 1926.1101.

V. The contractor shall establish written emergency procedures to be posted adjacent to the work area. These procedures shall include plans for medical emergencies, fire evacuation, temporary loss of electrical power or water and procedures for repair and clean-up following temporary breach of containment barriers.

W. The AAC must follow all applicable asbestos regulations, including but not limited to, 40 CFR (USEPA), 29 CFR (United States Department of Labor [USDOL]), 49 CFR (United States Department of Transportation [USDOT]), and NJ Uniform Construction Code.

X. All abatement procedures listed are recommendations. The AAC must submit, in writing, any alternate abatement procedures that are different from the recommended procedures to the ASCM for approval prior to the start of the project.

Y. All asbestos abatement work activities shall be performed between the hours of 7:00 a.m. and 4:00 p.m., Monday through Friday, except in cases of emergency. Work shift contingency shall be coordinated through the ASCM.

3.0 ASBESTOS DOCUMENTATION

3.1 NOTIFICATIONS

A. Notifications for abatement are required, as the project exceeds minimum thresholds:

1. NJ Department of Environmental Protection (NJDEP)
   Division of Solid Waste Management
   401 E. State Street, 7th Floor
   PO Box 402
   Trenton, New Jersey 08625-0402
   Attn: Asbestos Coordinator
   (609) 337-5669

2. NJ Department of Labor and Workforce Development (NJLWD)
   Asbestos Control and Licensing Section
   PO Box 494
   Trenton, New Jersey 08625-0949
   (609) 633-3760

3. NJ Department of Health (NJDOH)
   PO Box 360
   Trenton, New Jersey 08625-0360
   (609) 631-6749

4. US Environmental Protection Agency (USEPA)
   USEPA Region II NESHAP
   26 Federal Plaza, Room 1033
   New York, New York 10278
   (212) 264-7307

5. Any other local, state, and/or federal agency that requires notification.

B. Notification to the agencies in Section A above shall include the following information:

1. An indication of whether the notice is the original or a revised notification with the applicable revision number.

2. Name, address, and telephone number of both the Client or its representative and the AAC owner or its representative, including a contact name and phone number and the AAC's license number.

3. The Monitoring Firm hired by the Client is Montrose Environmental, 500

Horizon Drive, Suite 540, Robbinsville, New Jersey 08691, (609) 890-7277 (ASCM No. 00131). The Montrose Project Manager is Mr. Julian Fernandez-Obregon.

4. Occupancy status of building during abatement.

5. Type of operation: renovation.

6. Description of the facility or affected part of the facility, including the size (square feet and number of floors), age, and present and prior use of the facility.

7. Procedures, including analytical methods, employed to detect the presence of friable ACM and Category I and Category II non-friable ACM.

8. Estimate of the approximate amount of friable ACM to be removed from the facility in terms of the length of pipe in linear feet, surface area in square feet on other facility components, or volume in cubic feet if material is detached from the facility components. Also, estimate the approximate amount of Category I and Category II non-friable ACM in the affected part of the facility that will not be removed before demolition.

9. Location and street address (including building number or name and floor or room number, if appropriate), city, county, and state of the facility being demolished or renovated.

10. Scheduled starting and completion dates of asbestos removal work (renovation, demolition, or any other activity, such as site preparation, that would break up, dislodge, or similarly disturb asbestos material). Planned renovation operations involving individual operations shall only include the beginning and ending dates of a report period based on the predicted combined additive amount of ACM to be removed or stripped in that period.

11. Description of planned demolition or renovation work to be performed and method(s) to be employed, including demolition or renovation techniques to be used and description of affected facility components and type of work area containment.

12. Description of procedures to be followed in the event that unexpected friable ACM is found or Category II non-friable ACM becomes crumbled, pulverized or reduced to powder.

13. Name, address, and telephone number of the NJDEP Registered Waste Transporter and of the NJDEP Registered Landfill where the asbestos waste will be deposited.

14. The name and address of the ASCM firm retained to perform air monitoring on behalf of the Contractor's employees.

C. Application for a Construction Permit

1. The Building Owner or AAC shall be responsible for obtaining a construction permits from the local building official. The application shall include the following information:

   a. The name, address and license number of the NJLWD licensed AAC.
   b. The asbestos hazard assessment (asbestos survey), prepared by Montrose Environmental, Inc.
   c. The name and address of the private air monitoring firm, hired by the building owner, who shall act as the ASCM.

2. Four (4) sets of plans and specifications indicating:

   a. The scope of proposed work
   b. Type and percentage of asbestos
   c. The total square footage of ACM to be abated.
   d. The provisions proposed to contain the ACM during the abatement work, including but not limited to, separation barriers, critical barriers, and the route of travel for removing asbestos waste form the work areas.
   e. A copy of the site plan
   f. A floor plan indicating exits

3. One (1) set of each approved plans and specifications shall be distributed to the construction official, the ASCM, the building owner, and the project site.

4. Statement of building occupancy limitations, as per the ASCM.

5. The name and address of the NJDEP registered asbestos waste hauler(s) and approved landfill(s) where the waste will be deposited.

6. The abatement project schedules.

7. The method of air sample analysis for determining air clearance in order to re-occupy the buildings.

3.2 REGULATORY COMPLIANCE

A. Prior to the start of each asbestos removal project, the AAC shall furnish a copy of their asbestos abatement license issued by the New Jersey Dept. of Labor and Workforce Development, as per N.J.A.C. 12:120, to the monitoring firm employed by the Client.

B. Prior to the start of each asbestos removal project, the AAC shall furnish documentation of the Client or his designated representative that the firm and its employees are familiar with the following regulations of the USDOL, OSHA, and the USEPA relating to the application, removal, disposal and treatment of asbestos:

1. OSHA regulations, namely: 29 CFR 1926.1101 (Asbestos in Construction Standard), 29 CFR 1910.134 (Respiratory Protection Standard) and 29 CFR 1910.20 (Access to Employee Exposure and Medical Records).

2. USEPA regulations, namely: Subparts A and M of 40 CFR Part 61 (NESHAP), and the provisions of EPA 40 CFR 763 (AHERA/ASHARA).

C. The AAC shall provide the Client and/or his designated representative, such as the ASCM, with documentation that all workers on the job (supervisors and asbestos workers) have a valid work permit issued by the New Jersey Department of Labor and Workforce Development (NJDLWD). No permit shall be issued unless the employee has taken a five-day course of training certified by the NJDOH, passed an examination given by the NJDOH, and demonstrated the ability to perform asbestos control and removal safely, in accordance with the current state of the art technology.

D. One copy each of the regulations cited in Article III shall be available in the AAC's business office and one copy of each shall be maintained in view at the job sites, available to both the public and the AAC's employees.

E. The AAC shall display, at each job site, copies of the documents required in articles I.A & B and all documentation required in Article III, below.

F. A list of emergency telephone numbers shall be maintained at each job site and shall include the Architect/Engineer, Building Representative, Monitoring Firm employed by the AAC, ASCM, Local Fire, Police, Emergency, Hospital and Health Departments, and the local administrative authority having jurisdiction.

G. The AAC shall be responsible for controlling access at the work sites and shall maintain a daily log of personnel entering each Work Area. A list of worker names shall be posted with their start and stop times for each day. Copies of daily log forms will be given to the Air Sampling Technician (AST) each day along with photocopies of the workers' valid permit.

H. The AAC shall have available at each job site a copy of current NJDEP registration certificate for the collector/hauler who is responsible for transporting asbestos waste materials from the job site to a landfill registered (ID #27) by the NJDEP to accept asbestos waste.

I. The AAC shall post at each job site documentation that all employees have received medical examinations, as required by OSHA, and documentation of respirator training and fit testing, as required by OSHA 1910.134.

J. The AAC shall strictly adhere to all precautions necessary for the safety and health of the workers in accordance with provisions of OSHA Standards 29 CFR Part 1926.

3.3 PRE-CONSTRUCTION MEETING AND SUBMITTALS

A. The AAC shall attend pre-construction meetings scheduled by the Architect/Engineer. The ASCM employed by the Building Owner shall also attend. At this meeting, the AAC shall submit the following documentation:

1. Copies of the AAC New Jersey Asbestos Abatement License and asbestos workers permits.

2. Written copies of the letter of notification required by Chapter 1, Article I, and construction permit and application.

3. A written proposed progress schedule, including commencement and completion dates, work shift hours, and number of employees.

4. Written plans for work site preparation, including diagrams of the locations of critical barriers, decontamination chambers, high efficiency particulate air (HEPA)-equipped air filtration units, bagging chambers, and emergency exits.

5. Safety Data Sheets (SDSs), manufacturer's specifications and examples of protective clothing and approved respirators, a copy of the corporate respirator training program, and proof of respirator fit testing for all employees expected to participate in the project, as required by OSHA 1910.134.

6. A written description of all removal methods to be employed, including the types and numbers of negative filtration units with the calculations and venting arrangement, decontamination sequence, use of glove bags, cleaning procedures, reconstruction, waste disposal (provision of the location of the registered landfill, registration number of the hauler, and

landfill receipts and manifests during the project), and daily log forms which will be submitted to the Air Sampling Technician (AST) at the end of every week or phase, whichever is sooner.

7. Medical records of all on-site employees, as required by OSHA 1926.1101, including physician name, date of most recent exam, and employee number.

8. A written delineation of the AAC's building responsibilities, including security, utilities, and pre-existing site conditions.

9. A written description of emergency procedures to be followed in case of injury or fire. This section must include evacuation procedures, source of medical assistance (name and phone numbers), and procedures to be used for access by medical personnel (Examples: First Aid squad and physician).

10. A written copy of all information presented at this meeting shall be saved and made available upon request to Local, State, and Federal Enforcement Officials.

B. Asbestos work shall not proceed until the Client and AAC agree on the details required in Article V.

C. Emergencies (such as accidents requiring medical attention) shall take priority over all other requirements of these specifications.

3.4 REQUIREMENTS FOR ASBESTOS DISPOSAL

All asbestos waste materials destined for disposal in New Jersey shall be wetted and packaged in permanently sealed, leak-tight containers (such as double 6-mil plastic bags) in accordance with 40 CFR 61.20-25 before it can be legally transported and disposed of in New Jersey. No haulage of loose asbestos is permitted in New Jersey. A locked, secure container shall be provided by the AAC if asbestos waste is to be stored unattended outside. The containers or wrapped materials shall be labeled using warning labels specified by OSHA standards as per 29 CFR 1910.1001 or 1926.1101. The labels shall be printed in letters of sufficient size and contrast so as to be readily visible and legible. Labels must also contain the name of the waste generator and the location at which the waste was generated.

A. Prior to disposal, a notification of intent to dispose of asbestos shall be sent to the NJDEP at least ten (10) days prior to actual disposal. The notification shall be sent to the NJDEP, 7th Floor, Division of Solid Waste Management, Enforcement Element, 401 E. State Street, Po Box 402, Trenton, New Jersey 08625-0402, and shall include the following information:

1. Name, address, and telephone number of the generator and physical location of removal project.

2. Quantity and nature of waste materials to be disposed.

3. Name, address, and NJDEP registration number of hauler.

4. Name and address of the disposal facility to be used.

5. Date of proposed disposal.

B. All asbestos waste must be removed from the waste chamber during times when the building is least occupied.

C. Asbestos waste, which is properly packaged and classified as Waste ID #27, non-hazardous industrial waste, can be disposed of at a landfill which is registered by the NJDEP in conformance with the following:

1. The landfill used must be registered by the NJDEP to accept Waste ID #27.

2. The waste hauler must possess a valid solid waste transporter registration issued by the NJDEP. A licensed solid waste transporter shall be a commercial collector/hauler or shall be the removal company if they are so registered.

3. Asbestos waste can be hauled in trucks or dumpster containers provided the load is comprised only of asbestos in bags and does not contain any other wastes or ACW that could compromise the integrity of the permanent containers. If other materials are present in the load that could potentially puncture the permanent containers, then those containers shall be enclosed in temporary fiber or steel containers during loading, transport, and unloading operations. In addition, asbestos wastes shall not be loaded into or hauled with vehicles containing compaction devices as the normal compaction cycle will threaten the integrity of the permanent container - also refer to N.J.A.C. 7:26A.8(1) and N.J.A.C. 7:26-3.5(d).

4. To determine which facility to use for a particular project, contact the Division of Hazardous Waste Management at (609) 426-0700, or consult the New Jersey Waste Flow Regulations (N.J.A.C. 7:26-6.5). A Representative of the NJDEP Division of Waste Management will routinely monitor asbestos transport and disposal operations. They will check for compliance with asbestos handling and disposal directives in addition to the general requirements for waste handling under the Solid Waste Management Act. Violations of the Act and/or regulations promulgated thereunder are punishable by a penalty of $25,000.00 per day per violation.

D. The AAC shall supply to the Client the original "Generator's Copy" of the Waste

Manifests within five (5) business days of receipt of the loads at the designated landfill. In addition, the AAC shall supply to the project supervisor high quality copies of the Waste Manifests within five (5) business days of receipt of the load at the designated landfill.

1. USEPA NESHAP requires a notification when asbestos waste is not received by the landfill within 45 days after leaving the site of generation. The transporter and/or owner/operator of the designated landfill must be contacted about the status of the waste shipment within 35 days if the waste has not been received. It is recommended that transporter and/or landfill owner/operator be contacted within 15 days if the waste shipment has not been received.

4.0 ASBESTOS METHODS OF REMOVAL

4.1 PROTECTIVE CLOTHING AND EQUIPMENT

A. Clothing: Protective clothing shall consist of disposable full body coveralls, with hoods and booties attached. Separate disposable head covers and foot covering may be substituted if disposable coveralls without attached hoods and booties are used. Additional clothing shall include boots or sneakers and gloves. Eye protection and hard hats shall be available as appropriate.

B. Respirators: The AAC shall provide the required respirators and protective clothing to all workers, and to all official representatives of the Client, State, or other governmental entity, and the AST who may inspect the job site.

C. During the preparation for the work site, AACs may choose between three (3) types of respiratory protection as specified. In order of increasing effectiveness, they are:

1. Half-face or full-face respirators equipped with dual cartridge air purifying, high efficiency filters (P-100) and certified by the NIOSH for use in atmospheres containing asbestos.

2. Powered air-purifying respirators certified by NIOSH for use in atmospheres containing asbestos.

3. Type "C" supplied air respirators, either continuous flow or pressure demand class, as certified by NIOSH.

D. Respiratory protection must comply with the exposure limits described in OSHA 29 CFR 1910.1001 and OSHA 29 CFR 1926.1101. Additional protection must be provided as needed when workers can be exposed to other hazards.

E. The AAC shall require that each person entering the work area wear an approved respirator and protective clothing. THERE SHALL BE NO EXCEPTIONS TO THE RULE.

F. Air Filtration Units: unnecessary for this project as the abatement is entirely to occur on the exterior façade of the front entryway.

4.2 WORK AREA PREPARATION

A. All fire-retardant materials, where applicable, must meet the Uniform Construction Code.

B. The work area is outside the building, but the interior of each door where caulking is to be removed shall be covered with two layers of 6-mL polyethylene sheeting, caulked at the seams.

4.3 DECONTAMINATION

A. A remote decontamination area will be utilized for this project, given the limited containment and exterior removal procedures.

B. It shall be the AAC's responsibility to ensure all employees follow the appropriate procedures, including the decontamination procedures listed in Article IV. Employees who repeatedly violate proper procedures shall be subject to disciplinary measures by the AAC, including dismissal if necessary. There shall be no exceptions, except for emergency evacuations.

4.4 WORK AREA ISOLATION

A. The work area is on the exterior of the building and will be isolated from the interior during the preparation phase.

4.5 SEQUENCE OF ASBESTOS REMOVAL

A. A drop cloth is to be placed at the ground level against the building where caulking is to be removed.

B. The caulking is to be removed via wet-scraping on the exterior of the building, utilizing hand tools as appropriate.

4.6 FINAL CLEAN-UP OF WORK AREA

A. The following procedures must be accomplished utilizing all previously specified protective clothing and equipment.

B. The AAC shall first clean all surfaces in the work area using disposable cloths wetted with amended water. These cloths shall be disposed of or rinsed thoroughly on a frequency sufficient to eliminate visible accumulation of debris. Then, when these surfaces have been allowed to dry sufficiently, all surfaces shall be cleaned again using a HEPA filtered vacuum. (NOTE: A HEPA vacuum will fail if used on wet material).

C. Place any contaminated articles or debris into the bag with the waste.

D. Twist the top of the bag closed, fold this over, and seal with duct tape. Label the bag with labels prescribed by 40 CFR Part 61, Subpart M of the USEPA, 29 CFR 1926 of OSHA and 49 CFR--Parts 100-199 of the US DOT Hazardous Waste Hauling regulations.

E. Asbestos-containing waste material shall be disposed of as noted above.

F. Air sampling shall be conducted on the interior of the entryway, where the temporary sheeting has isolated the area from the exterior work area..

G. Air monitoring within the work area may then proceed.

1. The concentration of asbestos fibers shall not exceed 0.01 fibers/cc using PCM, NIOSH Method 7400, or 70 asbestos structures/mm^2 via TEM) as may be required under 40 CFR Part 763, Section 763.90. The volume of the air sample shall be sufficient to provide this level of sensitivity.

2. If the test results show asbestos fiber concentrations in excess of 0.01 fibers/cc or 70 structures/mm^2, then clean-up shall be repeated until compliance is achieved. Re-clean all surfaces and operate HEPA-equipped negative air filtration units to exhaust air to the exterior of the building, in order to filter the air.

4.7 RECONSTRUCTION

A. After each work area is found to be in compliance with Article VII; A-F, the following tasks shall be performed by the AAC:

1. The temporary poly sheeting shall remain on the interior of the entryway doors.

2. The exterior entryway shall be weatherproofed, utilizing plywood, poly sheeting, and caulked as appropriate, as reconstruction of the area may not occur for several days after abatement.

3. Plastic sheeting, tape, and any other debris shall be disposed of in sealed plastic bags labeled as asbestos-contaminated waste.

5.0 ASBESTOS MONITORING AND REPORTING

The specifications of Chapter 3 are provided only as information to the AAC.

All work herein described shall be performed as one single contract responsible to the Client and the services of both an ASCM and AST. The AAC shall be responsible for the removal, transport, and disposal of ACM, as well as the protection of building systems affected by the work, such as mechanical, electrical, communication, fire protection, means of egress, and plumbing. This work shall be in addition to, and independent of, the OSHA-mandated air monitoring conducted on behalf of the AAC's employees.

5.1 SCOPE OF WORK

A. Removal Phase

1. A minimum of three samples per eight-hour shift shall be collected (one at the beginning of each shift, one every four hours thereafter, and one at the end of the contractor's workday).

2. Air samples are to be analyzed via NIOSH 7400 and verbal results made available for a determination regarding continued occupancy. A written record of test results shall be kept at the job site and included in the final report.

3. Monitoring outside each work area shall be provided throughout removal operations to ensure that no outside contamination is occurring.

4. Filter cassettes and sampling train shall be assembled as specified in NIOSH 7400. The flow rate shall be between 0.5 and 15 liters per minute. The total volume shall be sufficient to achieve a detection limit of 0.01 f/cc. Pumps shall be calibrated before and after sampling and a record kept of this calibration.

5. If the AAC's barriers or other control methods are observed to malfunction and if the AAC does not correct the problems immediately upon notification, then the work stoppage procedures shall be followed. In such a situation, additional sampling up to three samples per day shall be performed by the AST.

6. Analysis: NIOSH Method 7400.

7. The evaluation criteria: 0.01 f/cc.

8. A record shall be kept in a daily log of all on-site observations, inspections, and required activities of the AAC.

9. The AST shall ensure that all asbestos waste shall be removed from the work site by a NJDEP registered waste hauler.

10. The monitoring firm's primary responsibility is to ensure that the job is being conducted properly using the controls specified in the contract. An important aspect of the monitoring firm's responsibilities is close visual inspection. Recommendations can and shall be made on the basis of visual inspection.

11. Air monitoring does not prevent exposure; air monitoring will measure air levels and document the effectiveness of control efforts. The emphasis of the monitoring firm's activities shall be to control and prevent exposure by a rapid response to observe visual problems.

5.2 FINAL CLEARANCE

A. The AST shall provide monitoring of work area(s) within 48 hours of final cleaning and before removal of critical barriers. This test is required to establish safe conditions for removal of critical barriers and to permit reconstruction activity to begin. Sufficient time following clean-up activities shall be allowed so that all surfaces are dry during monitoring.

B. Sampling Procedure: Filter cassettes and sampling train shall be assembled as specified in EPA 40 CFR 763. The flow rate shall be between 0.5 and 15 liters per minute. PCM air samples are collected, with a flow rate between 0.5 and 10 liters per minute, and a total volume of at least 1,250 liters. Pumps shall be calibrated before and after sampling and a record kept of this calibration.

C. Analysis: NIOSH 7400 (PCM)

D. Evaluation Criteria: If test results exceed the criteria set by EPA 40 CFR 763, the AST shall so inform the AAC, the Client, and the A/E.

E. Final Inspection

1. Final inspection shall be conducted by the AST and the AAC's Supervisor upon written notice by the Client or AAC of satisfactory post tests and removal of critical barriers.

2. Following a satisfactory final inspection, the Client/agent shall apply for a Certificate of Completion. The ASCM shall then issue the Certificate of Completion.

5.2 FINAL REPORT

A. Upon satisfactory completion of all asbestos removal work and of all tests, the

ASCM shall submit a written final report to all parties identified in Chapter 1 Article I.A of this specification, including copies of all back-up records (charts, logs, calibration results, records, ventilation measurements, etc.) documenting the day-by-day progress of work and related tests. This report shall be presented in logical form, neatly bound, and property titled, dated, and signed. Any deviations from acceptable practice on the part of the AAC, and any unsatisfactory test results reported during the course of the job, shall be highlighted in the report for record purposes.

B. All reports by the AST specified herein may be submitted in legible, handwritten form in the interest of time constraints, to be resubmitted within the specified period in printed or typewritten form.

6.0 LEAD-BASED PAINT SUMMARY

LBP was identified throughout the Site, on original components, which included various door components, plaster and brick walls, stairwell components, window components, and wall trim. Lead-safe work practices and worker/occupant protection practices complying with current USEPA and Occupational Safety and Health Administration (OSHA) standards will be necessary to safely complete all work involving the disturbance of LBP coated surfaces and components.

LBP in amounts equal to or exceeding the USEPA and/or Lead Hazard Evaluation and Abatement Code criteria of 1.0 mg/cm^2 was found on the following painted substrates:

- Exterior – Doors and Door Frames, inclusive of decorative components
- Stairwells – All Components (Railing, Riser, Stringer, Bannister)
- Throughout – Original Brick, Concrete, & Plaster Walls (few)
- Throughout – Original Baseboards
- Throughout – Window Frames, Sills, and Sashes
- Throughout – Original Door Frames and Jambs
- Throughout – Original Archways and Trim

The above substrates are brick, wood, plaster, and concrete. Most plaster walls were negative via X-Ray Fluorescence (XRF) for LBP, but any impact to concrete or brick walls should be presumed to be LBP for upcoming renovations. All original wood components, doors, windows, baseboards, trim, etc., should be presumed to be LBP, and lead safe work practices be implemented when impacting those materials.

As outlined in the preamble to the U.S. Department of Labor OSHA Construction Standard for Lead (29 CFR 1926.62 Lead), the lead in construction standard is applicable to all occupational exposure to lead in all construction work in which lead in any amount is present in an occupationally related context.

Based on the detected levels of lead in paint, the OSHA Construction Standard for Lead (29 CFR 1926.62 Lead) is applicable to all construction work at this site since employees may be occupationally exposed to lead. OSHA has included within the regulatory text three lists of tasks, the performance of which in the presence of lead, trigger basic protective provisions prior to air lead monitoring:

Task-related Trigger-1

The OSHA regulation, section (d), part (2) "protection of employees during assessment of exposure," states that where lead containing coatings or paint is present and the affected components are to be demolished, manually scraped, manually sanded, treated with heat gun application and/or power tool cleaned with a dust collection system, that until the employer performs an employee exposure assessment and documents that the employee(s) performing the demolition/renovation is not exposed to lead in excess of 500 micrograms per cubic meter (ug/m^3), which is 10 times the Personal Exposure Limit (PEL), the employer shall treat the employee as if the employee were exposed to lead above the PEL, and not in excess of ten (10) times the PEL,

and shall implement employee protective measures.

Task-related Trigger-2

The OSHA regulation, section (d), part (2) "protection of employees during assessment of exposure," states that where lead containing coatings or paint is present and the affected components are to be rivet busted, power tool cleaned without dust collection systems, cleanup activities where dry expendable abrasives are used, abrasive blasting enclosure movement or removal or using lead containing mortar (lead burning), that until the employer performs an employee exposure assessment and documents that the employee(s) performing the listed tasks is not exposed to lead in excess of 500 ug/m^3, the employer shall treat the employee as if the employee were exposed to lead in excess of 500 ug/m^3 and shall implement employee protective measures as outlined within the regulation. Where the employer does establish that the employee is exposed to levels of lead below 500 ug/m^3, the employer may provide the exposed employee with the appropriate respirator prescribed for use at such lower exposures, in accordance with the regulation.

Task-related Trigger-3

The OSHA regulation, section (d), part (2) "protection of employees during assessment of exposure," states that where lead containing coatings or paint is present and the affected components are to be abrasive blasted, welded, cut or torched), that until the employer performs an employee exposure assessment and documents that the employee(s) performing the listed tasks is not exposed to lead in excess of 2,500 ug/m^3 (50X PEL), the employer shall treat the employee as if the employee were exposed to lead in excess of 2,500 ug/m^3 and shall implement employee protective measures as outlined within the regulation. Where the employer does establish that the employee is exposed to levels of lead below 2,500 ug/m^3, the employer may provide the exposed employee with the appropriate respirator prescribed for use at such lower exposures, in accordance with the regulation. Until the employer performs an employee exposure assessment and determines actual employee exposure, the employer shall provide the employee(s) with interim protection as follows:

A. Appropriate respiratory protection
B. Appropriate personal protective clothing
C. Change areas
D. Hand washing facilities
E. Biological Monitoring
F. Respiratory, Safety and Hazard Communication Training

Where the employer has previously monitored for lead exposures, and the data was obtained within the past 12 months during work operations conducted under workplace conditions closely resembling the process, type of material, control methods, work practices, and environmental conditions used and prevailing in the employee's current operations, the employer may rely on such earlier monitoring results to satisfy the requirements of the regulation if the sampling and analytical methods meet the accuracy and confidence levels of the regulation.

The employer of construction workers is responsible for the development and implementation of a worker protection program in accordance with 29 CFR 1926.20 and 29 CFR 1926.62 (e). To

implement the worker protection program properly, the employer needs to designate a competent person, i.e., one who is capable of identifying existing and predictable hazards or working conditions which are hazardous or dangerous to employees, in accordance with the general safety and health provisions of OSHA's construction standards.

At the minimum, the following elements should be included in the employer's worker protection program for employees exposed to lead:

- Hazard determination, including exposure assessment
- Engineering and work practice controls
- Respiratory protection
- Protective clothing and equipment
- Housekeeping
- Hygiene facilities and practices
- Medical surveillance and provisions for medical removal
- Training
- Signs; and
- Recordkeeping

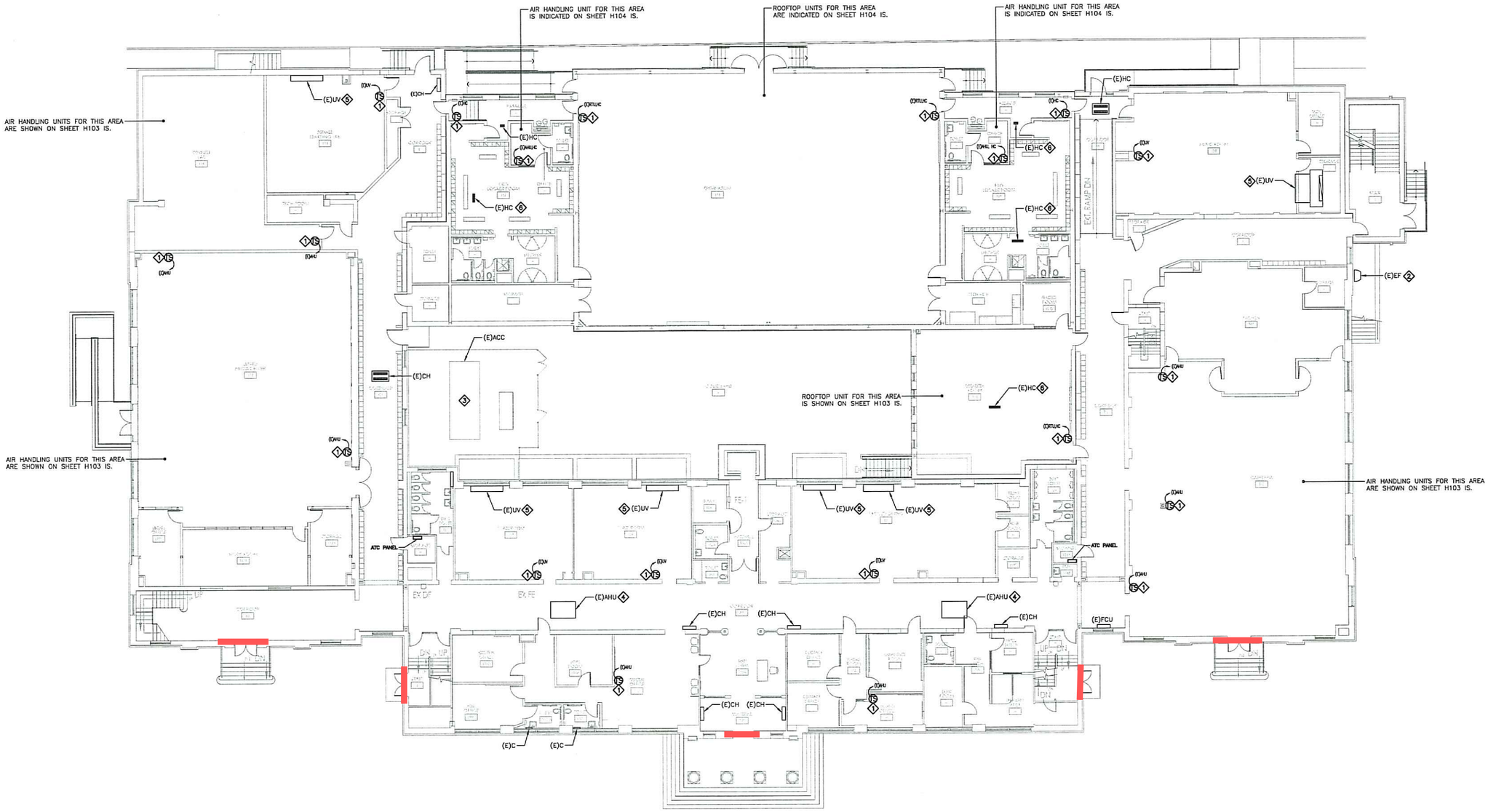
It is OSHA policy that respirators are not to be used in lieu of engineering and work practices to reduce employee exposures to below the PEL. Respirators can only be used in combination with engineering controls and work practices to control employee exposures. This report is for planning purposes only. This report should not be used as the sole document for lead related activities.

Appendix A

Proposed Work Area

NEW WORK NOTES:

1. REMOVE EXISTING THERMOSTAT AND PROVIDE NEW TEMPERATURE SENSOR. REFER TO AUTOMATIC TEMPERATURE CONTROLS SPECIFICATIONS.
2. CONNECT EXISTING EXHAUST FAN TO THE NEW DIRECT DIGITAL CONTROL SYSTEM. PROVIDE START, STOP AND STATUS. REFER TO CONTROL SPECIFICATIONS FOR ADDITIONAL DETAILS.
3. CONNECT EXISTING AIR COOLED CHILLER TO THE NEW DIRECT DIGITAL CONTROL SYSTEM. PROVIDE START, STOP AND STATUS. REFER TO CONTROL SPECIFICATIONS FOR ADDITIONAL DETAILS.
4. CONNECT EXISTING AIR HANDLING UNIT TO NEW DIRECT DIGITAL CONTROL SYSTEM. PROVIDE START, STOP AND STATUS FOR EACH FAN. REFER TO CONTROL SPECIFICATIONS FOR ADDITIONAL DETAILS.
5. CONNECT EXISTING UNIT VENTILATOR TO NEW DIRECT DIGITAL CONTROL SYSTEM. PROVIDE START, STOP AND STATUS. REFER TO CONTROL SPECIFICATIONS FOR ADDITIONAL DETAILS.
6. CONNECT EXISTING DUCT-MOUNTED HEATING COIL TO NEW DIRECT DIGITAL CONTROL SYSTEM. PROVIDE OUTPUT TO MODULATE CONTROL VALVE IN RESPONSE TO WALL MOUNTED TEMPERATURE SENSOR. REFER TO CONTROL SPECIFICATIONS FOR ADDITIONAL DETAILS.



1 H102 IS FIRST FLOOR ATC NEW WORK PLAN
SCALE: 3/32" = 1'-0"

Legend

= ACM Caulking Location

FIRST FLOOR KEY PLAN

1/29/2016
ISSUED FOR BID

Gillan & Hartmann, Inc.
MECHANICAL AND ELECTRICAL CONSULTING ENGINEERS
610-935-0101 FAX: 610-935-7520
215-238-9510 609-347-1593 302-654-5959
www.gillan-hartmann.com | gmail@gillan-hartmann.com
Cert. of Auth #24GA27932400 G&H Project No. 2015-203

ENGINEER MICHAEL S. GILLAN, PE
DATE 1/29/2016
NO. 24GE04470000

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FVHD architects planners
Fraytak Veisz Hopkins Duthie P.C.
FVHDPC.COM
Corporate: 1515 Lower Ferry Road - Ewing - New Jersey 08628
Pennsylvania: 140 Whitaker Ave - Mont Clare - Pennsylvania 19453

Project Name
REHAB PROJECT AT GLASSBORO INTERMEDIATE SCHOOL

Project Owner Name
GLASSBORO PUBLIC SCHOOLS

Project Location
202 N. DELSEA DRIVE, GLASSBORO, NJ 08028

Project Number: 4522D
Project Date: 01.29.2015
Checked By: KLH
Drawn By: MEN
Scale: AS NOTED

Drawing Name
HVAC - ATC FIRST FLOOR NEW WORK PLANS

Revisions

No.	Date	Description

Drawing Number
H102 IS

FILE PATH: G:\projects\2015\2015204 Glassboro High School_Constr Admin_Conformed Drawing Set\2015-203 Intermediate\H101 ATC.dwg

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

1. This Section includes the following:
    1. Work covered by the Contract Documents
    2. Contract
    3. Specification formats and conventions
    4. Use of premises.

2. Related Sections include the following:

    1. Division 01 Section “Construction Facilities and Temporary Controls” for limitations and procedures governing temporary use of Owner’s premises.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

1. Project Identification:

    1. Project Location: Rowan University, Glassboro, New Jersey

        a. 202 Delsea Drive, Glassboro, NJ 08028

    2. Owner: Rowan University

2. Architect Identification: The Contract Documents were prepared for Project by:

    1. DIGroup Architecture, LLC
    15 Bethany Street
    New Brunswick, NJ 08901

3. The Work consists of the following:

    1. The Contractor will be permitted to conduct their building surveys once the letter of award is issued. Contractor shall also begin the submittal process.
    2. Contractor must outline in their bid any long lead items that may impact their ability to meet the deadlines of the schedule.
    3. Rowan University has submitted the Plans and Specification to DCA for the Plan Review Process.
    4. Contractor is responsible for submitting and securing all necessary permits to complete the work.
    5. Bid shall include all systems improvements as shown on the Glassboro Intermediate School Technical Specifications and Design Documents issue under this IFB.

6. Contractor must follow all OSHA and Rowan safety guidelines and procedures.
7. Contractor shall Schedule and Coordinate all work activities with Rowan University.
8. Contractor must bid the project to meet the schedule outlined in the bid documents which may include weekend and/or shift work. Contractor must staff the project accordingly to meet the schedule since the end date is firm. Rowan will not entertain change orders for contractor's inability to meet this schedule or time extensions, except as a result of force majeure as set forth in Section 1.7.C. below.
9. Contractor is responsible to schedule and manage all required inspections, including but not limited to F-final certificate of occupancy inspection.
10. Contractor is required to maintain a clean job site and to turn over the building back to the owner in the condition is was received.
11. Contractor is responsible to perform final cleaning prior to Final Turn Over and Owner's Final Acceptance

1.4 CONTRACT

A. Project will be constructed under a single prime general construction contract with a Project Labor Agreement (PLA).

1.5 USE OF PREMISES

1. General Construction Operations: Contractor shall have limited use of premises for construction operations, including a limited use of the project site (outside the facilities exterior walls) during the period of construction activity. Contractor's use of the premises is limited by Rowans right to perform work or to retain other contractor's on portions of the Project or to limit access for events or other functions as the University might require. The Contractor will be given notice of any such events well in advance so that arrangements can be made to insure the prosecution of the work continues as scheduled.

4. Arrange use of site and premises to allow:

    1. Owner occupancy.
    2. Work by others.
    3. Work by Owner.

5. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond the building perimeter unless prior approval of the University is received prior to conduction such work or operations.

    1. Limit site disturbance, as approved by Rowan University.
    2. **REFER TO SECTION 011400 FOR WORK HOURS.**
    3. Storage of construction materials and equipment is not permitted inside the existing building.
    4. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Rowan University, Rowans employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

        a. Schedule deliveries to minimize use of the driveways and entrances.
        b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

6. Use of Existing Building: Maintain existing building in a weather tight condition throughout

construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

7. **The Contractor will be responsible for photographing the entire area of work, adjacent spaces where incidental work may occur, corridors and elevators accessing the area of work, the loading area, and contractor parking area. The Contractor will provide Owner with digital copies of all the photographs prior to mobilization as a record of the existing conditions PRIOR to the start of the works. Digital format shall be in PDF format.**

1.4 SPECIFICATION FORMATS AND CONVENTIONS

1. Specification Format: The Specifications are organized into Divisions and Sections using the 48-division format and CSI/CSC's "MasterFormat" numbering system.

    1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

1.5 MISCELLANEOUS PROVISIONS

A. WORK REQUIRED TO BE PERFORMED UNDER THIS CONTRACT SHALL BE COMPLETED IN ACCORDANCE WITH THE FOLLOWING MILESTONES AND COMPLETION DATES. CONTRACTORS MUST INCLUDE IN THEIR BIDS ALL COSTS INCLUDING OVERTIME ASSOCIATED WITH INSURING THAT THE PROJECT IS COMPLETED BY THE MILESTONE DEADLINES LISTED HEREIN.

B. Summary of Milestones:

1. The Notice to Proceed (NTP) is anticipated by: January 23, 2026. The University intends to issue Notice to Proceed, Construction Contract, and/or University purchase order as evidence of contract award.
2. ALL submittals to Architect: Sixty (60) days after Notice to Proceed. Long lead items to be submitted first.
3. Architect return of reviewed of submittals by: Ten (10) business days after receipt.
4. **Substantial Completion** by December 24, 2026. This includes completed final inspections and Owner's beneficial use of space.
5. **Final Completion** of work on site by January 23, 2027. All construction punch list work, closeout documentation, final payment application, etc. will be completed by the date.

C. Weather Conditions:

1. Unfavorable weather conditions shall not be justification for delays in completion or final completion dates as specified. No change orders will be issued or approved for extensions of time due to weather conditions. Seasonal weather conditions shall be considered in the planning and scheduling of all work influenced by high or low ambient temperatures for the completion of all contract work within the allotted contract time. In addition, appropriate allowances shall be made for anticipated time losses due to normal rain and snow conditions by statistically expanding the estimated time durations for weather sensitive activities with the constraint that the substantial completion deadline cannot change.
2. The University may at its sole discretion entertain extensions of time from the contractor for weather related delays. However no extensions of time shall be considered by the

University until at least twenty-five (25) lost project schedule days have accrued. Lost time will accrue on a proportionate basis – 1/4 lost day will be charged as 1/4 lost day, 1/2 lost day will be charged as 1/2 lost day, and so forth. A lost project schedule day is considered a day or any portion of a day when all members of the construction workforce on the project cannot work due to inclement weather conditions. Whether or not the contractors' workforce fails to begin work or leaves the project site on any given day due to a claim of inclement weather a lost project schedule day will not be recognized by the University until it is approved in writing by the Owner's Project Manager.

3. Should the University approve an extension of time the contractor may only submit reimbursement for the cost of the extension of rental equipment agreements; bond premium and insurance adjustments at actual cost with no mark up; and general conditions directly impacted by the approved extension. Appropriate back up documentation as requested by the Owner's Project Manager must accompany any submission for reimbursement. Appropriate back up can be anything from copies of contractor's rental agreements showing rental durations, unit costs, rental rates, etc. to copies of superintendents pay stubs.

D. Intent of Contract: The drawings and specifications of the contract are intended to require the contractor to provide for everything reasonably necessary to accomplish the proper and complete finishing of the work. All work and materials included in the specifications and not shown on the drawings, or shown on the drawings and not in the specifications, shall be performed and/or furnished by the contractor as if described in both. Any incidental materials and/or work not specified in the drawings and/or the specifications which are, nevertheless, necessary for the true development thereof and reasonably inferable therefrom, the contractor shall understand the same to be implied and required, and shall perform all such work and furnish all such materials as if particularly delineated or described therein. Should there be an obvious error between the drawings and specifications, the most stringent constraints of the conflicting information shall be assumed by the contractor and it shall be the contractor's responsibility to complete the work as reasonably required, consistent with the intent of such drawings and specifications as may be interpreted by the University.

E. Coordination with other contractors: The contractor is advised that other contractors, subcontractors, and Owner-retained vendors may be performing work on the Project site concurrently with the Work of this Contract. Such work may occur within, adjacent to, or in shared access routes serving the areas of the project.
   1. Concurrent Operation:
      a. The Contractor shall anticipate, plan for, and coordinate its work with the activities of other contractors working on-site.
      b. Contractor shall cooperate fully with the Owner, Architect, and other contractors to avoid conflicts, delays, and interference with the progress of the overall project.
   2. Coordination requirements:
      a. Attend coordination meetings as required by the Owner and Architect.
      b. Modify sequencing, access, and scheduling of the work, when directed, to allow safe and efficient execution of concurrent work.
      c. Provide reasonable access, utilities, and shared use of spaces required by other contractors to perform their work.
   3. Protection and responsibility:
      a. Protect the work from damage resulting from activities of other contractors.
      b. Promptly notify Owner of any conflicts, interferences, or unsafe conditions resulting from overlapping work.

F. Damage to the Work caused by failure to coordinate or protect shall be corrected by the Contractor at no additional cost to the Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 011000

SECTION 011400 – WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to weekdays (Monday through Friday) from 7:00 AM to 5:00 PM. Weekend and Holiday work may be permitted if approved by the Owner.
2. Owner Occupancy: Allow for Owner occupancy of building, site and use by the public.
3. Driveways and Entrances: Keep streets, driveways and entrances serving premises clear and available to owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Use of Existing Building: Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.3 OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy site and existing building during entire construction period. Cooperate with owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations.

1.4 WORK SEQUENCE

A. Work shall be completed within the schedule as outlined in Section 011000 – Summary. University intends to issue Notice to Proceed, Construction Contract, and/or University Purchase Order as evidence of contract award on or before Project start date listed.

1.5 CONTRACTOR WORK AREAS, WORKING CONDITIONS AND EQUIPMENT STORAGE REGULATIONS

A. The Contractor shall not unreasonably encumber the facilities with its equipment or work to be performed. Work conducted by the Contractor, Subcontractor, or any other person and/or firm affiliated with the Contractor shall be contained within pre-designated working areas established by the documents.

B. The Contractor shall, at all times during the progress of the work, keep the site free from the accumulation of all rubbish and debris caused by its performance. The Contractor shall remove all debris and rubbish related to its work at the end of each workday to the satisfaction of the Owner's Project Manager. Tool storage boxes shall not be permitted inside the building on the first floor or outside the building.

C. The Contractor shall adequately secure and protect its equipment, materials and vehicles. The University assumes no liability for any damage to, or theft of, the Contractor's property. The Contractor shall have the use of a designated area for storage and staging of construction materials and equipment. The Contractor shall be responsible for adhering to security procedures outlined by the Owner's Project Manager.

D. The Contractor is responsible for all safety precautions for all of its employees and property while performing its services.

E. The Contractor shall strictly limit its employees' use of the facilities for lunch, smoking or rest time usage to only those areas designated by the Owner's Project Manager. Use of facility telephones will not be allowed. Use of building toilet facilities shall not be permitted. Smoking is not allowed inside the building.

1.6 WORK STOPPAGES, EXISTING UTILITY INTERRUPTIONS, NOISE AND ODOR RESTRICTIONS, AND MATERIAL APPROVALS

A. Work Stoppages – DOES NOT APPLY.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than five (5) working days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's Project Manager's written permission.

C. Consideration shall be given by the Contractor regarding odors emanating from adhesives and sealants, etc and excessive noise. If the odors or noise are such that they may disturb the employees and guests, then such work shall be performed while the building is not occupied. This determination shall be at the sole discretion of the Owner's Project Manager. The playing of radios and other unnecessary noise will not be permitted at any time.

D. All material safety data sheets shall be submitted and approved by the Owner's Project Manager prior to use of the material.

E. The playing of radios and other unnecessary noise will not be permitted at any time.

1.7 PROTECTION OF INTERIOR FINISHES

A. The Contractor shall take extra care to avoid damage or soiling to any part of the facility. The Contractor is responsible for all damages or destruction caused directly or indirectly by its performance to any part of the building or adjoining property. Any damage or destruction caused by the Contractor or its employees will be repaired or replaced as the Owner's Project Manager directs and to their satisfaction with all costs charged to the Contractor. The costs may be deducted from any and all amounts due to the Contractor.

B. Any of the Contractor's employees found defacing, damaging or marring the building or its finishes or contents shall be immediately removed by the Contractor. The Contractor shall be charged for all remedial work to restore the damaged area or contents to their original condition to the satisfaction of the State.

C. The Contractor shall take all necessary steps to ensure adequate protection of all building furniture, equipment and building finishes, including but not limited to: floors, walls, ceilings, windows, draperies, blinds, carpeting, doors, doorways and contents. In this endeavor, all workers are to take precautions to protect rugs and floors. The Contractor shall be charged for all remedial work to clean, repair and/or replace items damaged by the Contractor to the satisfaction of the State.

D. The Contractor is responsible for the cost of cleanup of dust, dirt and stains caused by the work to the satisfaction of the Owner's Project Manager. The Contractor shall take all necessary precautions to keep dust, dirt and debris to a minimum both within the construction area and throughout the buildings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 011400

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order Directive **THE ALLOWANCE SHALL BE INCLUDED IN THE BASE BID**.

B. Types of allowances include the following:

1. Lump-sum allowances.

C. Related Sections include the following:

1. Division 01 Section "Quality Control Services" for procedures governing the use of allowances for testing and inspecting.
2. Divisions 02 through 48 Division Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

A. If applicable, at the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architects request and Owners approval, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

D. All Allowances will be recorded as separate line items on the initial Schedule of Values to be approved by the Owner and/or Architect. Once the initial Schedule of Values is approved all subsequent Schedule's will continue to include these Allowances as separate line items. Allowances will be tracked as separate line items.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials and shall include taxes, freight, and delivery to Project site.

B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials accepted by Owner under this Section shall be included as part of the allowance.

1.7 UNUSED MATERIALS

A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

1.8 UNUSED ALLOWANCES

A. All unused Allowances are and will remain the Owner's property. The Contractor shall return any remaining Allowance balances to the Owner upon completion of all punch list items and Final Acceptance of the Building.

1. Allowance balances will be returned to the Owner by Change Order.

2. Change Orders for returning Allowance balances to the Owner will be initiated and approved prior to the Contractor submitting for Final Payment. Allowance balances will not be included in the Final Application for Payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

Lump Sum Allowance No. 1, Construction Permits: $ 350,000 (Three Hundred Fifty Thousand Dollars)

END OF SECTION 012100

SECTION 012200 – UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012500 “Contract Modification Procedures” for procedures for submitting and handling Change Orders.
2. Section 014000 “Quality Control Requirements” for general testing and inspection requirements.

1.3 DEFINITIONS

A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor’s measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner’s expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Refer to “HOURLY LABOR RATE BREAKDOWN”

B. Unit Price No. 1: Plaster Repair

a. Description: Repair interior plaster where damage has occurred beyond what has been documented in the construction documents.

b. Unit of Measurement: Square feet of plaster repair.

C. Unit Price No. 2: Brick Repointing

a. Description: Repair exterior brick where damage has occurred beyond what has been documented in the construction documents.

b. Unit of Measurement: Square feet of brick repointing

A. END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. If specification Sections are referenced in alternate schedule, the specification section contains the requirements for materials necessary to achieve the work described under each alternate. If specifications are not listed in the schedule below, base the alternate price on the

description below.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF ADD – ALTERNATES

A. No Add Alternates scheduled

3.2 SCHEDULE OF DEDUCT – ALTERNATES

A. **Deduct Alternate #1:** Remove Site Lighting for existing parking lot along Fish Pond Road as shown on the drawings.
B. **Deduct Alternate #2:** Remove parking lot asphalt seal coat over existing pavement as shown on the drawings
C. **Deduct Alternate #3:** Remove second & third floor gang toilet rooms: In second floor Men's Lav and Women's and third floor Men's Lav and Women's Lav, remove from the bid the demolition and installation new plumbing fixtures and all associated piping, insulation, and appurtenances. Remove the installation of new lighting fixtures and controls as shown. Remove all proposed flooring, walls, ceiling finishes, accessories and toilet partitions. The HVAC and fire protection scope in these rooms is to be included in base bid.
D. **Deduct Alternate #4:** Remove first floor gang toilet rooms: In first floor Men's Lav and Women's, remove from the bid the demolition and installation new plumbing fixtures and all associated piping, insulation, and appurtenances. Remove the installation of new lighting fixtures and controls as shown. Remove all proposed flooring, walls, ceiling finishes, accessories and toilet partitions. The HVAC and fire protection scope in these rooms is to be included in base bid.

END OF SECTION 012300

SECTION 012400 – PROCEDURES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, General Conduct of the Work and Special Requirements, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 DESCRIPTION OF WORK

A. The types of minimum requirements for procedures and performance or control work of a general nature, to be fulfilled collectively by contractors, include but are not necessarily limited to the following categories:

1. Coordination and meetings.
2. Administration/supervisory personnel.
3. Examination and checking of contract drawings.
4. Surveys and records or reports.
5. Limitations for use of site.
6. Protection of Persons and Property.
7. Special reports.
8. Subcontractor, material approval.
9. Tradesmen and workmanship standards.
10. Inspections, tests and reports.
11. Progress photographs.
12. General installation provisions.
13. Control Wiring.
14. Chases, recesses and openings.
15. Sleeves, built-in items.
16. Cutting and patching.
17. Uncovering and correction of work.
18. Cleaning and protection.
19. Conservation and salvage.

1.3 COORDINATION AND MEETINGS

A. General: Contractor shall prepare a written memorandum of general instructions on required coordination activities including notices/reports/meetings and distribute memorandum to each engaged entity performing work at project site, with copies to Architect and Owner.

B. Coordination Drawings: Where work by separate entities requires off-site fabrication of products and materials which must be accurately interfaced and closely intermeshed to produce required results, prepare coordination drawings to indicate how work shown by separate shop drawings will be interfaced, intermeshed, and sequenced for installation.

1. Comply with submittal requirements of "Submittals" section, and other requirements outlined in the other Divisions.

C. Biweekly Job Meeting: The Contractor’s Project Manager and Superintendent, the Owner's

Project Manager and the Architect shall attend biweekly job meetings convened by the Owner for the purpose of affording the opportunity to review Contractor's coordination efforts, to expedite the performance of administrative tasks, and to generally assess the work progress. Contractor shall require representation (at each meeting) by every entity currently involved in coordination or planning for the work (of the entire project). Contractor shall participate in meetings in a manner, which will resolve coordination problems.

1. Time and location of job meetings shall be designated by the mutual agreement of the Contractor, Architect and Owner.
2. Job meetings shall be chaired by the Architect, who shall record the proceedings in the form of minutes and shall be responsible for proper distribution thereof to all parties. Initial minutes will be distributed within three (3) business days after the meeting.
3. Any and all corrections or clarifications to these minutes shall be received by the Architect in writing within three (3) days of their issuance. After the interval allowed for corrections and clarifications, Job Meeting Minutes will stand as part of the project record.
4. All decisions, instructions and interpretations given by Owner, with concurrence of the Architect, at these meetings shall be binding and conclusive on Contractor.
5. Architect and Owner shall have the right to schedule Special Job Meetings or increase the frequency of job meetings if, in his opinion, the progress and condition of the work warrant it. Attendance at such meetings is mandatory.
6. Subcontractors and suppliers shall attend at the request of the Architect or Owner as appropriate to the agenda topics at each meeting.
7. Agenda:

    a. Review of Work progress.
    b. Field observations, problems, and decisions.
    c. Identification of problems, which impede planned progress.
    d. Maintenance of Progress Schedule- updated by Contractor and discussed at every meeting.
    e. Corrective measures to regain projected schedule milestones and deadlines.
    f. Planned progress during succeeding work period and two (2) week look ahead.
    g. Effect of proposed changes on progress schedule and coordination.
    h. Review and update Submittal Log for every meeting.
    i. Other business relating to the Work.

D. Pre-Construction Meeting: Owner will schedule a meeting after Notice of Award.

1. Attendance Required:

    a. Owner.
    b. Architect.
    c. Contractor.

2. Agenda:

    a. Execution of Owner/Contractor Agreement.
    b. Submission of executed bonds and insurance certificates.
    c. Distribution of Contract Documents.
    d. Submission of list of Subcontractors, list of Products, schedule of values, etc.
    e. Procedures and processing of field decisions, submittals, substitutions, applications for payment, proposal requests, Change Orders, and Contract closeout procedures.
    f. Scheduling (Preliminary Progress Schedule by Contractor).

3. The above Agenda is a comprehensive list of items that could be discussed at the Pre- Construction Meeting. Some items will be included while the Owner may choose to handle other items by other means.
4. Architect will record minutes and distribute copies within two (2) days after meeting to participants, with two copies to Contractor, Owner, and those affected by any decisions made.

E. Pre-Installation Conferences:

1. When required by individual specification sections, contractor shall convene a pre-installation conference prior to the start of installation for the portion of work in question.
2. Require attendance of all Subcontractors, suppliers, manufacturers (if necessary), Owner Architect (at the Owners request), Engineers (at the Owners request) directly affecting of affected by the Work in question.

F. Application for Payment “PENCIL COPY” review meeting:

1. Contractor to schedule a Pencil Copy Review Meeting five (5) working days prior to payment period deadline stipulated in the Agreement.
2. Contractor will be responsible to incorporate all agreed upon changes to the Pencil Copy version of the Application and submit the revised Application in accordance with all Contract requirements.

1.4 ADMINISTRATIVE/SUPERVISORY PERSONNEL

A. General: In addition to a Home Office Project Manager and a Field Construction Superintendent and other administrative and supervisory personnel required for performance of the work, the Contractor shall provide specific coordinating personnel as may be required for proper interface between the trades and other work of the total project.

B. Project Superintendent: The Contractor shall provide a full-time Project Superintendent, who is experienced in administration and supervision of building construction of a type similar in nature and scope to this Project, including mechanical and electrical work, and who is hereby authorized to act as the general coordinator of interfaces between the work of all the trades. For purpose of this provision, "interface" is defined to include the scheduling and sequencing of work, sharing of access to work spaces, installations, each trade's protection of work by other trades, cutting and patching, tolerances, preparation of coordination drawings, inspections, tests, and temporary facilities and services.

C. Submittal of Staff Names, Duties: Within 15 days of contract date, the Contractor shall submit to the Owner and Architect a listing of Contractor's principal staff assignments and consultants, naming persons and listing their addresses, telephone numbers and past construction experience.

1.5 EXAMINATION AND CHECKING OF CONTRACT DOCUMENTS

A. Contractor shall be responsible for reviewing the contract documents in accordance with the requirements specified herein.

1. Contractor shall examine and check all quantities and dimensions given on contract drawings, and shall be responsible for noting any errors which can be discovered by such examination and check, and shall be responsible for satisfactory joining and fitting of all parts of the work; any check or observation by Architect/Engineer shall not

relieve the Contractor of any responsibility as to correctness of the work.

2. Field verification of dimensions on drawings is specifically directed and required of the Contractor as a matter of course, because locations, distances and elevations will be governed by actual field conditions. Contractor shall review plans, site plans and details of construction on the drawings, and adjust his work to conform to all conditions indicated thereon or reasonably inferable therefrom.
3. Discrepancies shown on different plans and details, or between drawings, and actual field conditions, or between drawings and specifications, shall promptly be brought to the attention of the Architect for interpretation and resolution.
4. If, in Contractor's opinion, any work is indicated on drawings or specified in such a manner as will make it impossible to produce such in conformance with the contact, he shall refer same to Architect for interpretation. If additional and supplementary instructions are necessary, Architect/Engineer will prepare and issue same in an appropriate form to the Contractor, with a copy being forwarded to the Owner.
5. Contractor is directed never to scale dimensions or locations from contract drawings. Consult Architect/Engineer for dimensions and locations of all items.

1.6 SURVEYS AND RECORDS/REPORTS

A. General: Working from lines and levels established by property survey, and as shown in relation to the work, the Contractor shall establish and maintain bench marks and other dependable markers to set lines and levels for the work at each story of construction and elsewhere on site as needed to properly locate each element of entire project. Contractor shall calculate and measure required dimensions as shown (within recognized tolerances if not otherwise indicated); and shall not scale drawings to determine dimensions. Advise tradesmen performing the work, of marked lines and levels provided for their use in layout of work.

1.7 LIMITATIONS FOR USE OF SITE

A. General: It is the intent of the Owner to preserve the present character of the campus to the greatest extent possible, both during and after the period of construction. To this end the Contractor will be subject to certain operational controls in the movement of personnel and equipment on and off the construction site. The Contractor's cooperation with the general goal of protecting and preserving the Institute campus, and with the specific controls specified hereinafter, shall be mandatory. The following general controls shall be observed:

1. Construction activities, including location of temporary support facilities, stockpiling of materials, loading and unloading, parking for construction personnel and other related activities shall be restricted to areas as specified by the Owner.
2. The accumulation or stockpiling of debris, rubbish or other material resulting from demolition or construction operations will not be permitted. Removal and off-site disposal must proceed concurrent with demolition and construction activities, to the end that the site shall at all times present a neat, orderly and workmanship appearance. No liquid or solid material of any kind is to be disposed of on campus property. No burning of trash or debris will be permitted on the site.
3. The Contractor shall be responsible for the prevention, abatement and control of any environmental pollution arising from demolition or construction activities in the performance of the work, in full compliance with all applicable Federal and State laws and regulations.

    a. Existing trees and other vegetation on and adjacent to the project site shall be protected. Refer to Section 015000 - "Temporary Facilities" - for specific requirements concerning fencing. Under no circumstances shall materials be stored or heavy equipment operated beneath the drip lines of existing trees.

4. Contractor shall be responsible for the control of dust arising from demolition or construction operations within the project site or along the Access Routes.

B. Allocation of Space: In addition to site utilization limitations and requirements shown on drawings, and indicated by other contract documents, Contractor shall administer allocation of available space equitably among separate subcontractors and other entities needing access and space, so as to produce overall efficiency in performance of total work of project.

C. Deliveries: Contractor shall schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

D. Construction Access:

1. Contractor shall plan, coordinate and execute all construction activities in such manner as to avoid traffic disruption over local streets.

   a. Prior to the start of work, Contractor shall contact the Police Department and determine approved travel routes for delivery vehicles on local streets.
   b. Contractor shall obtain and pay for all necessary permits in connection with the operation of overweight and over length vehicles on City streets.

2. Contractor shall be responsible for controlling all traffic entering and leaving the Owner's property including provision of flagmen as necessary. Contractor shall be responsible to require mud removal from rubber-tired vehicles departing the immediate project site. Operation of tracked vehicles shall be restricted to the project site as defined by the contract limit lines, and is not permitted on paved areas.
3. Whenever and wherever the project work must be performed outside the contract limit lines, and after the necessary permits have been secured from local authorities, Contractor shall erect and maintain barricades, danger signals and warning signs at working sites, closed roads, intersections and other places of danger to traffic, the work, or the public. Barricades and obstructions of any kind shall be marked with lights or flares at not more than five (5) foot intervals visible for a distance of not less than 500 feet. Contractor shall provide sufficient watchmen and traffic directors and shall take all necessary precautions for the proper protection of the work and the safety of the public.
4. Contractor shall be responsible for identification, control and maintenance of construction traffic within the contract limit lines. Identification and control shall include the provision of temporary traffic signs and the installation of barricades and warning lights to protect the work and to identify excavations or other hazards, all as may be required. Maintenance shall include the provision and placing of ballast materials as may be required, grading and compaction, removal of debris, removal of snow, and general care to insure a serviceable roadbed at all times.

   a. The Owner shall be responsible for snow removal from paved roadways and parking lots in the vicinity of the project area, but not within the work areas or areas immediate to the Contractor's temporary facilities.

5. Prior to final completion, perform all cleaning and repairs as necessary to restore all existing areas within the limits of any and all work required as a part of the scope of these contract documents, to their original condition.

E. Temporary Parking for Construction Personnel: The Owner shall designate available areas for parking.

1. Offsite parking will be available for employee parking, in an area to be designated by the Owner on RUI property. Construction personnel will not be permitted to park in campus parking lots, except as specifically designated and authorized by the Owner. The designated parking area may change due to seasonal demands of the Owner.

F. Staging and Storage Area: The Contractor shall have the authority and responsibility to plan and locate storage areas, equipment marshaling areas, and temporary field facilities. Staging and storage areas shall be so located and utilized as to afford unrestricted access to all of the work at all times. Such areas shall not encroach upon access routes to the work, nor shall they be so located or utilized as to impede free access of emergency vehicles. Such areas must be approved by the Owner prior to use by the contractor.

1. Staging and storage areas shall be located wholly within the contract limit lines and site enclosure fence.
2. All loading and unloading operations shall occur inside the contract limit lines and behind the site enclosure fence.
3. Storage of materials and equipment outside the site enclosure fence or on City streets is absolutely prohibited.
4. Prior to final completion, perform all cleanup, disposal, grading, topsoiling, seeding and other work as necessary to restore the entire staging/storage area to its original condition.

G. Verification of Underground Utilities: Contractor shall have the responsibility to verify the actual locations of existing underground utility lines. Should verified underground utility locations conflict with excavation required in connection with the work, Contractor shall notify the Owner's Project Manager immediately. Hand excavation shall be required at locations in close proximity to verified existing utilities.

1. The Owner does not guarantee the accuracy and completeness of information shown on any contract drawings for underground utilities; Contractor must be responsible for ascertaining all facts concerning utility locations.
2. Damage to existing underground utilities, caused as a result of Contractor's negligence or failure to comply with the requirements listed herein, shall be repaired and/or replaced at Contractor's expense, to the complete satisfaction of the Owner and utility company by close of business of the day of damage.

H. Cleaning and Trash Disposal: Comply with requirements specified in Section 01500, "Temporary Facilities".

1.8 PROTECTION OF PERSONS AND PROPERTY

A. Safety Precautions and Programs: Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. He shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent, unless otherwise designated by the Contractor, in writing, to the Owner.

B. Protection of Persons: Contractor shall take all necessary precautions for the safety of employees on the work, and shall comply with all applicable provisions of Federal and State safety laws, union safety regulations, and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the work is being performed. Particular attention is called to the requirements of the Federal Occupational Safety and Health Act (OSHA). In connection with the work of its own forces, Contractor shall direct and properly maintain, at all times, as required by the conditions and progress of the work, all necessary

safeguards for the protection of workers and the public and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hoists, well holes, elevator hatchways, scaffolding, window openings, stairways and falling materials.

1. Security/protection provisions are specified in "Temporary Facilities" section.

C. Protection of Work and Property: Contractor shall take all precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

1. All the work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his Subcontractors, or Sub-subcontractors; and
2. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

a. Refer to "Temporary Facilities" section for specific requirements concerning fencing around existing trees.

D. Emergencies: In any emergency affecting the safety of persons or property, Contractor shall act with diligence, at his discretion, to prevent threatening injury, damage or loss. In such case, he shall immediately notify the Owner, of the action taken and shall forthwith prepare and submit a detailed and documented report to the Owner and the Architect.

E. Insurance and Indemnification: Comply with requirements of the Contract Agreement.

1.9 SPECIAL REPORTS

A. General: Except as otherwise indicated, submit special reports directly to Owner within one day of occurrence requiring special report, with copy to Architect/Engineer and others affected by occurrence.

B. Reporting Unusual Events: When an event of unusual and significant nature occurs at site, the Contractor shall prepare and submit a special report listing chain of events, persons participating, response by Contractor's personnel, evaluations of results or effects, and similar pertinent information. When such events are known or predictable in advance, it is the responsibility of the Contractor to advise the Owner in advance at earliest possible date.

C. Reporting Accidents: Contractor shall prepare and submit reports of significant accidents, at site and anywhere else work is in progress. Record and document data and actions; comply with industry standards. For this purpose, a significant accident is defined to include events where bodily injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

1.10 SUBCONTRACTOR, MATERIAL APPROVAL

A. Material Approval: Contractor shall submit to the Owner and Architect, for approval, a list of all vendors and manufacturers for the supply of materials and equipment, whether specified or not, starting within fifteen (15) calendar days after award of contract; said list shall be complete within forty-five (45) days thereafter. In instances where specified materials and equipment are subject to the Owner’s and Architect's approval by way of the submittal process, no contract shall be entered into with any vendor, supplier or manufacturer before the Owner and Architect have approved his name in writing.

B. Subcontractor Approval: Contractor shall, beginning within fifteen (15) calendar days after award of contract and ending within forty-five (45) days thereafter, notify the Architect and Owner in writing of the names of all subcontractors proposed for the work, and shall not employ any without prior written approval of the Owner, or any that Owner may within a reasonable time reject.

1.11 TRADESMEN AND WORKMANSHIP STANDARDS

A. General: Contractor shall instigate and maintain procedures to ensure that tradesmen performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality-levels for workmanship in completed work. Remove and replace work, which does not comply with workmanship standards as specified and as recognized in the construction industry for applications indicated. Remove and replace other work damaged or deteriorated by faulty workmanship or its replacement.

B. Availability of Tradesmen: At each progress or job meeting, Contractor shall review availability of tradesmen and projected needs to accomplish work as scheduled. Require each entity employing tradesmen to report on current and pending trade actions and jurisdictional matters, which might affect progress of work. Where possible dispute or delay is identified, consider alternatives and take actions to avoid disputes and delays.

1.12 INSPECTIONS, TESTS AND REPORTS

A. General: Required inspection and testing services are intended to assist in determination of probable compliances of the work with requirements, but do not relieve Contractor of responsibility for those compliances, or for general fulfillment of requirements of contract documents. Specified inspections and tests are not intended to limit Contractor's quality control program. Afford reasonable access to agencies performing tests and inspections.

B. Inspection and Testing by Independent Agencies: General requirements are specified in "Quality Control Services" section of these specifications (Section 01400). Particular requirements are specified in the technical sections (Divisions 02 through 48).

C. Inspection and Testing by Authorities with Jurisdiction: If the Contract Documents, laws, ordinances, rules, regulations or order of any public authority having jurisdiction require any portion of the Work to be inspected, tested or approved, the Contractor shall give the Owner not less than five (5) working days notice in writing of its readiness for inspections or testing. The Contractor shall bear all costs of such inspections, tests or approvals conducted by public authorities.

D. Inspection and Testing by Contractors: When inspections and tests are required by the technical sections of these specifications to be performed by Contractors on installed materials and equipment, all such inspections and tests shall be conducted in the presence of, and upon timely notice to, the Owner, and the results thereof approved prior to acceptance of the installation. Fuel, power and any other items or services required for the proper inspecting and testing of equipment and for the period of instructing the Owner's operating personnel shall be at the cost and expense of the Contractor furnishing such equipment.

E. Special Inspection and Testing: If the Owner or Architect/Engineer determines that any Work requires special inspection, testing or approval, not otherwise required herein, he will instruct the Contractor to order such special inspection, testing or approval, and the Contractor shall give notice as provided in subparagraph C. If such special testing or inspection reveals a failure of the Work to comply with the requirements of the Contract Documents, the

Contractor shall bear all costs thereof, including compensation for the Architect/Engineer's additional services made necessary by such failure; otherwise the Owner shall bear all costs and an appropriate Change Order will be issued.

1.13 PROGRESS PHOTOGRAPHS

A. Refer to Specification Section 01300, “Submittals” for requirements pertaining to Progress Photographs.

B. Provide photographs of the site and construction throughout progress of Work produced by an experienced photographer or job superintendent experienced in taking construction photographs, acceptable to the Owner.

C. Take photos in a timely fashion to allow for their submission with each application for a payment and/ as follows (as applicable):

1. Installation of site utilities.
2. Installation of footings.
3. Installation of foundations.
4. Building pad proof roll.
5. Building pad sub grade (vapor barrier and stone).
6. Installation of concrete floors, decks, walls, etc.
7. Installation of masonry for stair towers, elevator, exterior walls, etc.
8. Installation of structural steel, steel deck and joist, etc.
9. Rough grading.
10. Installation of parking lot paving, parking lot lighting, line stripping, etc.
11. Installation of interior and exterior framing.
12. Plumbing and electrical rough-ins.
13. HVAC ductwork and units.
14. Installation of telecommunications cabling and devices.
15. Installation of roofing.
16. Installation of windows, doors, hardware, etc.
17. Enclosure of walls and ceilings.
18. Interior and exterior finishes.
19. Installations of millwork, casework, trim work, etc.
20. Landscaping
21. Final Completion.

D. Digital PDFs: Color photos. 4” X 8” or larger of each view. Provide enough photos at each stage of construction to give someone not familiar with the Project a clear understanding of the progress of the work. Review photos with the Owner’s representative at each stage of construction requiring photographs. The Owner will determine if additional photos will be needed.

1. PDF format.
2. Identify each print. Identify name of Project, orientation of view, date and time of view.

E. Deliver prints with each Application for Payment or at times specified by Owner with transmittal letter.

1.14 MANAGEMENT SOFTWARE

A. The contractor to be provided with a user account by the university to access Trimble Unity

Construct, formerly eBuilder. Trimble Unity Construct is a web-based project management software solution to be used by the architects, consultants, construction manager, and owner. The Contractor shall utilize this software solution throughout the project duration for all related project documentation including, but not limited to Requests for Information, submittals, daily reports, correspondence, meeting minutes, change orders, etc.

1.15 REQUESTS FOR INFORMATION

A. The Contractor is to prepare and submit a Request for Information (RFI) through web-based project management tool for action when a clarification and/or additional information is required to perform an activity of work.

B. The request must include a drawing and/or specification reference when applicable and must also include a proposed solution for review by the Architect. Requests not provided with a recommended solution, if applicable, will be returned to the Contractor with no action until such recommendation is provided.

C. The Construction Manager and Architect will endeavor to respond to requests in a timely manner so not to impact onsite activity. It is the Contractor’s responsibility to review the Contract Documents thoroughly for planned work and submit a request with sufficient time for the Construction Manager and Architect to review and respond. If the Contractor fails to carry out this responsibility, The Contractor will not be entitled to an extension of time and/or additional incurred costs should the request impact construction progress.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Pre-Installation Conference: Well in advance of installation of every major unit of work which requires coordination and interfacing with other work, Contractor shall meet at project site with subcontractors, installers and representatives of manufacturers and fabricators who are involved in or affected by unit of work, and in its coordination or integration with other work which has preceded or will follow. Contractor shall advise Owner and Architect of scheduled meeting dates. At each meeting review progress of other work and preparations for particular work under consideration, including requirements of contract documents, options, related change orders, purchases, deliveries, shop drawings, product data, quality control samples, possible conflicts, compatibility problems, time schedules, weather limitations, temporary facilities, space and access limitations, structural limitations, governing regulations, safety, inspection and testing requirements, required performance results, recording requirements, and protection. Contractor shall record significant discussions of each conference, and agreements and disagreements, along with final plan of action. Distribute record of meeting promptly to everyone concerned, including Architect/Engineer and Owner.

1. Do not proceed with the work if associated pre-installation conference cannot be concluded successfully. Instigate actions to resolve impediments to performance of the work and reconvene conference at earliest date feasible.

B. Installer's Inspection of Conditions: Require Installer of each major unit of work to inspect substrate to receive the work, and conditions under which the work will be performed, and to

report (in writing to Contractor) unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

C. Manufacturer's Instructions: Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in contract documents.

D. Inspect each item of materials or equipment immediately prior to installation and reject damaged and defective items.

E. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerances if not otherwise indicated. Allow for expansions and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual-effect choices to Architect for final decision.

F. Recheck measurements and dimensions of the work, as an integral step of starting each installation.

G. Install work during conditions of temperature, humidity, exposure, forecasted weather, and status of project completion, which will ensure best possible results for each unit of work, in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.

H. Coordinate enclosure (closing-in) of work with inspections and tests, so as to minimize necessity of uncovering work for that purpose.

I. Mounting Heights: Except as otherwise indicated, mount individual units of work at industry-recognized standard mounting heights, for applications indicated. Refer questionable mounting height choices to Architect/Engineer for final decision.

3.2. The contractor shall include in his/her proposal the cost of all control wiring and its installation for all mechanical equipment including, but not limited to, heating, ventilating and air conditioning systems, ATC systems, boilers, remote monitoring systems, etc. which systems require electrical control wiring. The contractor shall employ a sub-contractor approved by the University for all such control wiring. The sub-contractor shall provide a final certificate of electrical inspection of the control wiring. Installed or control wiring must connect to a point of electrical power supply as shown on the contract documents.

3.3 CHASES, RECESSES AND OPENINGS

A. Contractor shall build chases, recesses, openings, channels and flues, and shall leave or create holes where shown on drawings, or where directed for piping, electrical conduits, switchboxes, panelboards, flues and ducts, or any other feature of the mechanical and electrical work. All trades requiring chases, recesses, openings, etc. shall furnish to the Contractor, complete detailed drawings for all chases, recesses and openings required in connection with such work in ample time to allow the construction to proceed without interruption or delay. Comply with requirements of "Submittals" section of these specifications.

1. Contractor shall close, build in and finish around or over all chases, recesses, openings, etc. after installation of mechanical and electrical work has been completed. Should any fail to furnish the above required information in time, the Contractor shall,

at their own expense, arrange for all cutting, rebuilding, patching and finishing, but shall employ the Contractor whose work must be cut to do so.

2. Contractor shall obtain prior written approval from the Architect/Engineer and the Owner before cutting or boring through beams, floor construction or supporting members.

3.4 SLEEVES, BUILT-IN ITEMS

A. Each trade shall be responsible for furnishing and setting of sleeves, built-in items, anchors, inserts, etc. for his work. Contractor shall build these items into the construction.

1. Comply with requirements of "Submittals" section in the preparation of sleeve drawings.

3.5 CUTTING AND PATCHING

A. General: Do not cut-and-patch structural work in a manner resulting in reduction of load-carrying capacity or load/deflection ratio; submit proposed cutting and patching to Architect/Engineer for structural approval before proceeding. Do not cut-and-patch operational elements and safety-related components in a manner resulting in reduction of capacities to perform in manner intended or resulting in decreased operational-life, increased maintenance, or decreased safety. Do not cut-and-patch work which is exposed on exterior or exposed in occupied spaces of building, in a manner resulting in reduction of visual qualities or resulting in substantial evidence of cut-and-patch work, both as judged solely by Architect. Remove and replace work judged by Architect to be cut-and-patched in a visually unsatisfactory manner.

1. Contractor shall do all cutting, fitting, adjusting and patching as may be required to permit the several parts to properly come together as intended and indicated.
2. Engage original Fabricator/Installer to perform cutting-and-patching of structural work, operational/ safety-related components, and visually exposed work; or, if not available, engage only recognized experts; employ only proven methods.
3. Do not cut or alter work performed under separate contracts without the Architect’s written permission.
4. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specific requirements and methods needed for proper performance of the work of this Section.
5. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.
6. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
7. Examine and verify specific conditions described in individual specification sections.
8. Verify that utility services are available, of the correct characteristics, and in the correct locations.
9. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

B. Materials: Except as otherwise indicated or approved by Architect/Engineer, provide materials for cutting-and-patching which will result in equal-or-better work than work being cut-and- patched, in terms of performance characteristics and including visual effect where applicable. Use materials identical with original materials where feasible and where recognized that satisfactory results can be produced thereby.

C. Temporary Support and Protection: Provide adequate temporary support for work to be cut, to prevent failure. Do not endanger other work. Provide adequate protection of other work during cutting-and-patching, to prevent damage; and provide protection of the work from adverse weather exposure.

D. Cut work using methods least likely to damage work to be retained and work adjoining.

1. Where physical cutting action is required, cut work with sawing and grinding tools, not with hammering and chopping tools. Core drill openings through concrete work. Comply with the requirements of applicable sections of Division 02 where cutting-and-patching requires excavating and backfilling.
2. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
3. At penetrations of fire rated walls, partitions, ceilings, or floor construction, completely seal voids with fire rated materials in accordance with Section 07841 to full thickness of the penetrated elements.
4. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

E. Patch with seams, which are durable and as invisible as possible. Comply with specified tolerances for the work.

1. Where feasible, inspect and test patched areas to demonstrate integrity of work.

F. Restore exposed finishes of patched areas; and, where necessary extend finish restoration onto retained work adjoining, in a manner, which will eliminate evidence of patching.

1. Where patch occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing patch, after patched area has received prime and base coats.

G. Execute cutting and patching including excavation and fill to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide opening in the work for penetrations of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.

H. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original conditions.

I. **ALL CUTTING AND PATCHING SHALL BE CONSIDERED PART OF THE BASE BID PRICE WHEN THE WORK IS REQUIRED AS PART OF THE OVERALL PROJECT. NO ADDITIONAL PAYMENT WILL BE CONSIDERED FOR WORK OF THIS SECTION UNLESS ALL APPLICABLE PARTIES OBTAIN PRIOR AUTHORIZATION OR WRITTEN APPROVAL.**

3.6 UNCOVERING AND CORRECTION OF WORK

A. Comply with requirements of the General Conditions of the Contract, and with additional requirements specified herein.

1. Subsequent Disclosure of Faulty Work: Failure of Owner or Architect/Engineer to exercise powers of rejection or condemnation against the work of the Contractor

during construction shall not be construed as an acceptance on Owner's part or Architect/ Engineer's part that Contractor's work has been faithfully performed, if the fact be otherwise.

3.7 PROJECT CONDITIONS

A. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

C. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and air from discharge of noxious, toxic substances, and pollutants produced by construction activities. Comply with all governmental and code requirements.

3.8 PREPERATION FOR CUTTING AND PATCHING AND/OR NEW WORK.

A. Prepare surfaces and remove surface finishes to provide for proper installation of work and finishes.

B. Clean substrate surfaces prior to applying next material or substance.

C. Seal cracks or openings of substrate prior to applying next material or substance.

D. Apply manufacturers required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.9 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Owner’s Representative and Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect/Engineer and Owner’s Representative the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Utilize recognized engineering survey practices.

F. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including but not limited to pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations, etc.
2. Building foundation, column locations, all floor elevations, stairwells, elevator shafts, machine and mechanical rooms, etc.
3. All other work as necessary to complete all the requirements of the contract documents.

G. Periodically verify layouts by same means.

H. Maintain a complete and accurate log of control and survey work as it progresses.

3.10 GENERAL INSTALLATION REQUIREMENTS

A. Install Products as specified in individual sections and in accordance with manufacturer's recommendations.

B. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new Work abuts or aligns with existing, perform a smooth and even transition.

C. When existing finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendations to the Architect and Owner.

3.11 CLEANING AND PROTECTION

A. General: During handling and installation of work at project site, Contractor shall clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure freedom from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

B. Removal of all debris and rubbish resulting from or relating to the construction work; rubbish shall not be thrown from building openings above the ground floor unless confined within chutes.

1. Progress Cleaning:

a. Maintain areas free of waste material, debris, and rubbish (on a daily basis). Maintain site in a clean and orderly condition, as determined by the Owner.
b. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
c. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
d. Collect and remove waste materials, debris, and rubbish from site periodically and dispose of off-site.
e. Protect installed work and provide special protection where specified in individual specification sections.
f. Provide temporary and removable protection for installed Products. Control activity during and after installation in the immediate work area to prevent damage.
g. Protect finished floors and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials appropriate for the task involved.

C. Limiting Exposures of Work: To extent possible through reasonable control and protection methods, Contractor shall supervise performance of work in a manner and by means which will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period. Such exposures include (where applicable, but not by way of limitation) static loading, dynamic loading, internal pressures, external pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents,

chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.

D. Construction Debris: The Contractor shall intermittently remove waste and rubble so that at no time shall there be undue accumulations. Upon completion, the Contractor shall dress up all areas affected by this work whether inside or outside the boundary of the Project. Loading, crating, hauling and dumping will be at the contractor's expense.

E. Rubbish: The Contractor shall provide covered metal trash cans in sufficient quantity to accept the accumulation of rubbish and garbage from lunch and the like of employees of all Contractors working on site.

1. The Contractor shall instruct his and his subcontractors' employees to deposit their trash and garbage in these containers and not elsewhere about the site; and also not to use the containers for construction scraps, rubbish, trash and surplus materials.
2. The Contractor shall empty these containers daily and haul the rubbish to a legal disposal site off the property.

F. Roads and Pathways:

1. The Contractor is responsible for the removal of construction dirt and debris in public areas on the site and in the surrounding areas serving the site.
2. Dirt and mud tracked onto streets by the Contractor or its subcontractors is to be immediately cleaned up by the Contractor to the satisfaction of the Owner and the local municipal authorities.

G. Trucks: All trucks leaving the construction area are to be covered in accordance with NJDOT over the road requirements. Trucks leaving the site are to be clean and free of mud or other materials.

H. Quality Assurance: University streets and pathways are to be maintained in a clean safe condition at all times. Under no circumstances shall the Contractor leave the site each day without inspecting and verifying that streets and paths to the construction site, access areas, lay down areas, and gates in the area of the site are clean of all construction related materials and are clean and sage for use by the Rowan University population. The Contractor will immediately correct any violation of this provision upon notification by the Owner.

3.12 CONSERVATION AND SALVAGE

A. General: It is a general procedural requirement for Contractor's supervision and administration of the work that construction operations be carried out with maximum practical consideration for conservation of energy, water and materials; and with maximum practical consideration for salvaging materials and equipment involved in performance of the work but not incorporated therein.

END OF SECTION 012400

SECTION 012500 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:

1. Division 01 Section "Allowances" for procedural requirements for handling and processing allowances.
2. Division 01 Section "Unit Prices" for administrative requirements for using unit prices.
3. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect may issue through Owner's Project Manager supplemental instructions authorizing Changes in the Work, not involving adjustment to the Contract Time, as "Architects Supplemental Instructions" (ASI). Architects Supplemental Instructions may or may not involve adjustments to the contract sum. THERE WILL BE NO ADJUSTMENTS TO THE CONTRACT TIME ALLOWED FOR THIS PROJECT.

1. For ASI's involving no adjustment to the contract sum or time, the contractor is authorized to execute the change or clarification immediately.
2. For ASI's resulting in an adjustment to the contract sum, do not consider them instructions either to stop work in progress or to execute the proposed change without obtaining written authorization from the Owner. Written authorization can include the provisions of the general conditions, Article 14, paragraphs 14.5.3 and 14.7.1, an approved change order or a Construction Change Directive.

B. The technical specifications may refer to certain brand name products by name/or catalog number. This is done to establish standards of quality. Is it not being done to intentionally eliminate competition. If the contractor deems a product equivalent or better quality from another supplier or manufacture where fully suitable in design and manufacturing, see Section 016350 Substitution Procedures.

1.4 PROPOSAL REQUESTS

A. In the event the Contractor believes that any change directed by the Owner or Architect would entitle it to additional compensation to complete its work under this contract, **the Contractor shall immediately notify the Owner's Project Manager of this fact WITHIN**

48 HOURS OF RECEIPT OF THE CHANGE REQUESTED. The contractor shall then prepare and submit an original of the Change Order Request (COR) with all supporting documentation to the Owner's Project Manager and submit two (2) copies of the Change Order Request (COR) with all supporting documentation to the Architect and University within five (5) calendar days of its receipt of the directive by the Owner and/or Architect.

B. Owner-Initiated Proposal Requests (OIPR): Owner may issue proposal requests or may have the Architect issue such requests. In any event a detailed description of proposed changes in the Work will be submitted to the contractor that may require adjustment to the Contract Sum. THERE WILL BE NO ADJUSTMENTS TO TIME FOR ANY GIVEN CHANGE ORDER REQUESTED. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. OIPR issued by Architect are for information only. For ASI's resulting in adjustments to the contract sum, do not consider them instructions either to stop work in progress or to execute the proposed change without first obtaining written authorization from the Owner.
2. If the contractor feels the ASI or OIPR requires a change to the contract sum then the contractor shall notify the Owner's Project Manager of this fact within 48 hours of receipt of the ASI or OIPR directive.
3. Within five (5) business days after receipt of directive, ASI or OIPR from the Owner, submit a Change Order Request (COR) estimating cost adjustments to the Contract Sum necessary to execute the change. The contractor shall then prepare and submit an original of the COR with all supporting documentation to the Owner's Project Manager and submit two (2) copies of the COR with all supporting documentation to the architect.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor directly attributable to the change.

        1) Labor shall be broken down by man-hours, hourly wages, fringe benefits per hour and any other benefits payable.

    d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float however the date of Substantial and Final Completion cannot be extended.

C. In the event that the Contractor encounters a condition that it considers a change, the Contractor shall immediately notify the Owner's Project Manager prior to disturbing the condition and shall then prepare and submit an original of the COR with all supporting documentation to the Owner's Project Manager and two (2) copies of a Change Order Request with all required supporting documentation to the architect within five (5) calendar days of encountering the condition. The condition shall not be disturbed until the Owner's Project Manager has inspected the condition.

D. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a Change Order Request (COR) to Owner's Project Manager. The contractor shall prepare and submit one (1) original of the

COR with all supporting documentation to the Owner's Project Manager and submit two (2) copies of the COR with all supporting documentation to the architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float however the date of Substantial and Final Completion cannot be extended.

E. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.5 ALLOWANCES (**IF APPLICABLE ON A GIVEN PROJECT**)

A. Allowance Adjustment: To adjust allowance amounts, base each Allowance Request Proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins. **Only allowances included as part of the Bid Price will be considered for an Allowance Authorization. All other Proposals must be hard costed.**

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within ten (10) business days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than ten (10) business days after such authorization.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower- priced materials or systems of the same scope and nature as originally indicated.

C. ***Use the same procedure(s) followed for handling Change Order Requests (COR's) and Change Orders with Allowances (except use Allowance Forms rather than Change***

Order Forms).

1.6 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Change Order Request (COR), the Owner will direct the Architect to issue a Change Order for signatures of the Contractor and Owner on AIA Document G701.

1. The Change Order breakdown shall be in sufficient detail to permit an analysis of all material, labor, equipment, sub-contract and overhead costs as well as profit. Any amount proposed for sub-contracts shall be supported by a similar price breakdown.

B. Each Change Order must contain a detailed description of the change and the amount by which the Contract Price will be increased or decreased.

C. COMPUTATION OF ADDITIONAL COMPENSATION

1. In connection with any request for additional compensation the Contractor shall furnish a price breakdown, as follows:

a. Labor shall be broken down by the man-hour, hourly wages, fringe benefits per hour and any other benefits payable by the Contractor;
b. Materials shall be broken down by quantity and unit prices.

2. Unless otherwise directed, the breakdown shall cover all work involved in the change whether such work was deleted, added or changed.
3. The breakdown shall be in sufficient detail to permit an analysis of all material, labor, equipment, sub-contract and overhead costs as well as profit. Any amount proposed for sub-contracts shall be supported by a similar price breakdown.
4. The following rates shall apply in computing indirect costs and profit for the negotiation of additional compensation under all provisions of this contract, which provide for such adjustments that do not exceed twenty-five thousand dollars ($25,000.00). The resulting change in the contract amount will include the indirect impact cost of extended performance computed in accordance with the terms of this article and no further consideration of such costs arising from the specific modification will be given. The percentages for overhead and profit shall be negotiated and may vary according to the nature, extent and complexity of the work involved. If not negotiated prior to the start of construction then the rates herein designated shall apply. The percentages shall be applicable for deleted work as well as additional work. When a change consists of both added and deleted work, the applicable percentages shall be applied to the net cost or credit. In any event, the percentages shall not exceed the sum of the following:

a. Overhead will be the sum of ten percent (10%) of direct labor costs.

1) For the purpose of the article, the term direct labor shall include all labor by contractor's employees necessary to perform the actual work on site. Foremen, equipment operators and skilled, semi-skilled and common laborers directly assigned to the specific operation are direct labor; project managers, superintendents, office personnel, and subcontractors are not direct labor.
2) The term direct labor costs shall consist of the contract or actual payroll rate of wage per hour and fringe benefits paid for each and every hour

that such employees are actually engaged in the performance of the work. Overhead will be the sum of ten percent (10) % of direct material costs.

b. Overhead will be the sum of ten percent (10%) of direct material costs.

1) For the purpose of the article, the term direct material costs shall consist of the actual costs of the materials, including applicable tax and transportation charges

c. For rented equipment, an hourly rental rate will be used which will be determined by using the monthly rental rates taken from the current edition of the rental rate blue book for construction equipment and dividing it by one hundred seventy-six (176). An allowance will be made for operating costs for each and every hour the equipment is actually operating in accordance with the rate listed in the aforesaid rental book. The contractor will be allowed only sixty-five percent (65%) of the rental rate on contractor owned equipment.

d. Bond premiums, insurance, payroll taxes and travel subsistence, if applicable, will be allowed at actual cost (only) for the equitable adjustment allowed. No mark-up will be allowed for overhead on these indirect cost items.

e. The contractor's profit on the sub-contractor's work will be five percent (5%) of the sub-contractor's costs. Sub-contractor indirect costs will be computed in the same manner as for the contractor. The contractor agrees to incorporate this article in each of it sub-contracts.

f. A profit of six percent (6%) where profit is allowable by the terms of the applicable contract provision shall be added to the contractor's total cost for the equitable adjustment allowed for the work conducted by the contractors own workforce. Indirect costs will not be duplicated in direct costs.

g. When more than one (1) tier of sub-contractors exists, they shall be treated as one (1) sub-contractor for the purpose of mark-ups.

D. ANY CONTRACTOR PERFORMING CHANGE ORDER WORK WITHOUT **WRITTEN** APPROVAL FROM THE OWNER DOES SO AT ITS OWN RISK.

1. Only the signature of an Assistant Vice President or above is authorized to give approval of a Change Order Request (COR) or Change Order (CO). The Owner's Project Manager is not authorized to approve change orders. The Owner's Project Manager is only authorized to verify the work in question is in addition to or outside the scope of work delineated on the original contract documents.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect at the direction of the Owner's Project Manager may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data

necessary to substantiate cost adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PERFORMANCE OF CHANGE ORDER WORK

A. A contractor who performs any scope of work associated with a change order or allowance (if allowances are applicable on a given project) without receiving proper approval in accordance with all contract document requirements hereof does so at its own risk. The Contractor shall have waived any and all claims for additional compensation related to said changes or conditions encountered.

END OF SECTION 012500

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:

1. Division 01 Section "Allowances" for procedural requirements governing handling and processing of allowances.
2. Division 01 Section "Unit Prices" for administrative requirements governing use of unit prices.
3. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
4. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with Continuation Sheets.
b. Submittals Schedule.

2. Submit the Schedule of Values submission to Architect and Owners Construction Manager in accordance with the general conditions and general conduct of work.

3. Sub schedules: Where the Work is separated into phases requiring separately phased payments, provide sub schedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

   a. Project name and location.
   b. Name of Architect.
   c. Architect's project number.
   d. Contractor's name and address.
   e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar values
   h. Cost totals.

      1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.

   a. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site.
   b. The University may, in its sole discretion, pay the Contractor for material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the contractor at locations other than the site may also be taken into consideration if (1) such consideration is specifically authorized by the contract and (2) the contractor furnishes a form entitled "Contractor's Summary of Stored Materials" and agreement and bill of sale certification, respectively, for stored materials and (3) the contractor furnishes evidence of insurance for said materials or a bonded warehousing agreement.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the

Work.

7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities. Allowances will only be accepted for items listed in the Bid Documents.

8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place must be shown as separate line items in the Schedule of Values.

9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

    a. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
2. Submit three (3) copies of each Application for Payment, at least five (5) business days prior to the actual submission date as specified. This Application will be reviewed and adjusted by all parties (Architect, Owner and Contractor) at a “**PENCIL COPY REVIEW”** meeting prior to final approval.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: The date for each progress payment is per the General Conditions. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 15 days before the date for each progress payment.

D. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Owner’s Project Manager will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before

last day of construction period covered by application.

F. Transmittal: Submit 3 (three) signed and notarized original copies of each Application for Payment to Owner's Project Manager by a method ensuring receipt within 24 hours. All copy's shall include 'Attachment to G702- Certification for Payment", Release of Liens Forms (included in the Contract Documents) entirely completed for the contractor, all subcontractors and anyone else whose payment is listed in the Schedule of Values for the application being requested, AIA G706 A-Contractors Affidavit…, Certified Payrolls and Monthly Work Force Reports, updated and current Construction Schedule, updated and current Submittal Log, and current Project Photograph's.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Release of Mechanic's Lien: With each Application for Payment, submit partial or final releases of mechanic's lien (as may apply) from every entity that is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or proceeded by final waivers from every entity involved with performance of the Work covered by the application that is lawfully entitled to a lien.
5. Release Forms: Submit release of lien on forms, executed in a manner acceptable to Owner. (Use Form listed in Division 0 of the Specifications).

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).

    a) A final schedule must be submitted prior to Owners payment of the second (2^{nd}) progress payment.

4. Products list.
5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.
16. Initial settlement survey and damage report if required.

17. Current construction photographs as specified herein.

I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final, liquidated damages settlement statement.

K. When Owner or Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Provide one (1) copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1. Any other information or documentation required by other provisions of the contract documents shall be supplied.

L. In order to be proper an Application for Payment must include the following as applicable:

1. Total amount, payee name and address, department/agency, payee declaration, payee reference number and identification number.
2. contract number, contractor’s name, period of the Application, completion date, number of sheets, amount due this period, amount to date, retainage, certification by payee, certification signed by the Project Manager and Architect and approval of payment signed by the contracting officer or his/her designee, previous payment requests, total deductions and additions.
3. In making progress payments for work, the University will retain ten percent (10%) of the approved invoice of payment until final acceptance and completion of all work covered by the contract.
4. Retainage shall be determined as follows: the Owner will withhold Five percent (5%) of the amount due on each partial payment when the outstanding balance of the Contract is more than Four Hundred Fifty Thousand Dollars ($450,000.00). When the outstanding balance of the Contract is Four Hundred Fifty Thousand Dollars ($450,000.00) or less, the Owner will withhold Ten percent (10%) as retainage. Retainage shall be withheld until the Owner determines that the work has been

satisfactorily completed and no unsettled claims exist. The final acceptance shall not be binding or conclusive upon the Owner should it subsequently discover that the contractor has supplied inferior material or workmanship or has departed from the terms of his contract. Should such a condition appear the Owner shall have the right, notwithstanding final acceptance and payment, to cause the work to be properly done in accordance with the drawings and specifications at the cost and expense of the contractor.

M. Upon acceptance and completion of each building or other clearly definable severable portion of the contract work for which the price is stated separately within the contract, payment may be made in full at the discretion of the contracting officer including retained percentages thereon less authorized deductions.

N. All authorized Applications are to be sent to the Owner's Project Manager at the address provided at the pre-construction conference. Receipt shall start the prompt payment clock unless returned to the contractor for correction within twenty (20) calendar days after receipt. Reference section 9.5 of the General Conditions.

1.6 FINAL PAYMENT

A. Upon final acceptance, the amount due the contractor under this contract shall be paid upon satisfactory completion by the contractor of all contract close-out requirements as required by the University, completion of a University audit on all contract values and payments and after the contractor shall have furnished the University with a final release of liens from the contractor and all subcontractors, sub-subcontractors, vendors, suppliers and any other entity affiliated with the contractor for completion of this project of any and all claims against the University arising by virtue of this contract other than claims in stated amounts as may be specifically excepted by the contractor from the release.

B. Upon satisfying the above conditions, the contractor shall submit a properly executed Application for Final Payment to the University through the Owner's Project Manager. The University Controller shall date stamp the Application. This action by the University Controller shall constitute receipt of a properly executed State invoice application.

C. If, for any reason, the contractor refuses final payment, the project shall be closed-out by the University unilaterally processing a final acceptance certificate. The University will hold all residual funds in escrow until all claims of the University and all contractors are satisfied.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 012900

SECTION 013100 – COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, General Conduct of the Work and Special Requirements, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:

1. General project coordination procedures.
2. Conservation.
3. Coordination Drawings.
4. Administrative and supervisory personnel.
5. Cleaning and protection.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 01 Section "Submittals" for preparing and submitting the Contractor's Construction Schedule.
2. Division 01 Section "Contract Closeout" for coordinating contract closeout.

1.3 COORDINATION

A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
3. Make provisions to accommodate items scheduled for later installation.

B. The mechanical, electrical and fire protection drawings are diagrammatic only and are not intended to show the alignment, physical locations or configurations of such work. Such work shall be coordinated by the Contractor and shall be installed to clear all obstructions, permit proper clearances for the work of other trades, satisfy all code requirements and present an orderly appearance where exposed at no additional cost to the Owner.

C. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Prepare and coordinate scheduling, delivery and processing of submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
2. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
3. Coordinate space requirements, supports, and installation of mechanical and electrical work, which are indicated diagrammatically on the Drawings. Follow routing shown for pipes, ducts and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.
4. Installation and removal of temporary facilities.
5. Progress meetings.
6. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
7. Coordinate completion and clean-up of work of separate sections.
8. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
9. Project closeout activities.

E. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.

1. Show the relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Comply with requirements contained in Section "Submittals."

a. Note the coordination drawing submittal requirements under Section 013300 "Submittals", paragraph 2.3.9

B. Staff Names: Within fifteen (15) days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and

responsibilities. List their addresses and telephone numbers.

1. Post copies of the list in the Project meeting room, and the temporary field office.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

END OF SECTION 013100

SECTION 013200 – CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions (Contract Administration Division Section D), General Conduct of the Work and Special Requirements, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUBMITTALS

A. Within three (3) days after the date established in the Notice to Proceed, University Contract and/or purchase order submit preliminary schedule indicating the scope of work for the duration of the project. A Gantt chart format will be acceptable however the final approved schedule must be in both a Gantt chart and CPM schedule format. If another method other than CPM is used the critical path and float time must be established and programmed into the schedule.

B. Initial Working CPM Schedule Submittal: To the extent necessary for the Contractor to reflect in the arrow diagram the plan for completion of this contract, the contractor shall meet with and furnish all necessary information for the preparation of the scheduling system within ten (10) calendar days after award of this contract. This information shall include, but not necessarily be limited to, logical sequencing of work operations; activity time estimated, intended crew flow, activity costs and estimated manpower requirements of each activity.

1. The contractor shall be responsible to reflect all sub-contractor work as well as his/her own work in proper coordinated sequence on the network diagram. The contractor shall be prepared to meet as many times as necessary with the Owner's Project Manager for the timely development of the project schedule.

1.3 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number. At a minimum provide the following.

1. Include a separate bar for each portion of work or operation.
2. Identify the first workday of each week.
3. Identify each critical path task or portion of work.
4. Identify task durations, predecessors and dependent tasks.
5. Identify milestone dates for completion/start of each critical path element.

B. The contractor shall utilize the earliest scheduled start and finish dates in planning, coordinating and performing the work under this contract including all activities of sub-contractors, equipment vendors and suppliers.

PART 2 - PRODUCTS – NOT USED

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONTENT

A. Construction logic and activity time durations shall be established by the contractor subject to approval by the Owner's Project Manager consistent with contract requirements and reflective of proper coordination between trades.

B. The Owner's Project Manager shall establish the specific level of detail to be reflected in the scheduling system.

C. Seasonal weather conditions shall be considered in the planning and scheduling of all work influenced by high or low ambient temperatures for the completion of all contract work within the allotted contract time. In addition, appropriate allowances shall be made for anticipated time losses due to normal rain and snow conditions by statistically expanding the estimated time durations for weather sensitive activities with the constraint that the substantial completion deadline cannot change.

D. The coordinated combined Progress Schedule the Contractor will develop shall incorporate the schedules of all Prime Contractors engaged on the project. The Schedule shall be in a form as specified herein and elsewhere in the contract documents and in sufficient detail to satisfy the Architect/Engineer and the University.

E. The Progress Schedule based upon the Contractor's logic and time estimates shall indicate, in suitable detail for display, all significant features of the Work of each Contractor, including the placing of orders and anticipated delivery dates for critical items and all other critical path activities, submissions and approvals of Shop Drawings, all work activities to be performed by each Contractor and the beginning and time durations thereof, float time and the dates of substantial and final completion of the various branches of the Work.

1. Show complete sequence of construction activity, with dates for beginning and completion of each element of construction.
2. Identify each item by specification section number or per bid form breakdown.
3. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
4. Indicate delivery dates as milestones for Owner-furnished items and any critical path items.
5. Provide legend for symbols and abbreviations used.
6. Show critical path tasks; differentiate them from other construction tasks.
7. Schedule will be based upon a five-day workweek.

3.2 REVIEW AND EVALUATION OF SCHEDULE

A. Review and Approval of Initial Working Schedule: Within ten (10) calendar days after receipt of the initial arrow diagram and computer produced schedule, the University's representative shall meet with the contractor and for joint review, correction or adjustment of the proposed plan and schedule to evaluate the cost values assigned to each activity. Within ten (10)

calendar days after the joint review, the Contractor will revise the arrow diagram and the computer- produced schedule in accordance with agreement reached during the joint review and shall submit two (2) copies each of the revised arrow diagram, computer produced schedule and cost requisition to the University. The resubmission will be reviewed by the University and, if found to be as previously agreed upon, will be approved. An approved copy of each will be returned to the Contractor. The contractor shall review the schedule to insure that it reflects all changes agreed to and, if all changes have been made, the contractor shall approve and sign the network diagrams, computer produced schedule and cost requisition listing at that time. Approval will be without reservation and the contractor will be deemed to have accepted the schedule as adequate, proper and binding in all respects and shall not raise objections to the schedule. After the network diagrams, computer-produced schedule and cost requisition listing have been signed, the Contractor shall forward one (1) set of signed copies of all scheduling documents to the Owner’s Project Manager. The arrow diagram and the computer-produced schedule with approved signatures shall constitute the project work schedule until subsequently revised in accordance with the requirements of this section.

B. Evaluate project status to determine work behind schedule and work ahead of schedule. Submit revised recovery schedule with action plan to bring “behind schedule” tasks and milestones back into original timeline.

3.3 UPDATING SCHEDULES

A. Maintain schedules to record actual start and finish dates of completed activities.

1. Updated schedules must be submitted at each progress meeting and with each application for payment or as required by Architect or Owner. These schedules must include the following:

   a. approved changes in activity sequencing;
   b. changes in activity durations for unstarted or partially completed activities where agreed upon;
   c. the effect to the network of any delays in any activities in progress and/or the impact of known delays, which are expected to affect future work;
   d. the effect of contractor modifications; i.e., activity durations, logic and cost estimates; to the network;
   e. changes to activity logic where agreed upon to reflect revision in the contractor's work plan; i.e., changes in activity duration, cost estimates and activity sequences for the purpose of regaining lost time or improving progress;
   f. changes to milestones, and due dates (except substantial completion) which have been agreed upon by the University since the last revision of the schedule.

B. At the same time the network is updated, the contractor and the University's representative shall jointly make entries on the preceding network diagram schedule to show actual progress, to identify those activities started by date and those completed by date during the previous period to show the estimated time required to complete each activity started but not yet completed, to show activity percent completed and to reflect any changes in the arrow diagram approved in accordance with the preceding paragraph. After completion of the joint review and the University's approval of all entries, the Contractor will submit updated network diagrams and an updated computer produced calendar dated schedule to the University and the contractor.

1. The resultant computer print-out and network diagrams shall be recognized by the contractor as solely his/her updated construction schedule to complete all remaining contractor work except that portion affected by interim University decisions.

3.4 DISTRIBUTION OF SCHEDULES

A. Upon approval at each level of schedule development (preliminary, final for Contractors work and Single Coordinated including all Prime Contractors work) the Contractor shall prepare and distribute (10) copies of the schedule at each level to the University. The Contractor shall also prepare and distribute two (2) copies of the final schedule showing Prime Contractors work to each Prime Contractor. In the event a new Prime Contractor is added to the job the General Construction Contractor shall furnish a revised schedule immediately with copies as indicated. The final coordinated schedule shall be signed and dated by all Prime Contractors involved and shall become part of the contract documents.

B. Distribute copies of updated (current) schedules to Contractors project site file, subcontractors, suppliers, Architect and Owner at each bi-weekly progress meeting. Also submit an updated (current) schedule with each Application for Payment or more often as required by the Architect and/or Owner.

3.5 SCHEDULE ADJUSTMENTS

A. Upon Owner and/or Architects request, if Contractor falls behind the approved schedule, the Contractor must submit a revised schedule to show how the Contractor intends to accomplish the completion of the work within the original contract time.

1. Within seven (7) days after receipt of notice from the Owner, the contractor shall submit to the University in writing an explanation of corrective action taken or proposed. The contracting officer shall make a decision binding on all parties after reviewing the written submissions.

B. Responsibility for Completion: The contractor agrees that whenever it becomes apparent from the current monthly computer produced calendar dated schedule that any contract completion date will not be met, he/she will take some or all of the following actions at no additional cost to the University.

1. increase construction manpower in such trades and numbers as will substantially eliminate the backlog of work in the opinion of the Construction Manager and contracting officer
2. increase the number of working hours per shift, shifts per working days, working days per week or the amount of construction equipment of any combination of the foregoing sufficiently to substantially eliminate the backlog of work in the judgment of the Construction Manager and contracting officer
3. reschedule activities to achieve maximum practical concurrence of accomplishment of activities

C. Lost time due to weather conditions will not accrue nor be credited to Contractor for weather delays with time added to the Substantial Completion milestone deadline. No weather delays will be granted once the building is under roof.

3.6 BI-WEEKLY REPORTING

A. Upon request from the Owner, the Contractor shall furnish for approval, his proposed

operating schedule for the next immediate two-week period of time. This schedule will be submitted at each bi-weekly progress meeting along with the overall updated schedule.

1. Every two (2) weeks, the Architect will conduct a coordination and scheduling meeting on the job site. At this meeting, the contractor shall provide detailed information in the form of a bar chart schedule regarding the work schedule to be performed during the upcoming two (2) weeks. Bi-weekly scheduling by the contractor shall be in accordance with the priorities and degree of concurrent work required by the official schedule for the project. The contractor shall be prepared to explain a difference between the contractor's bi-weekly schedules and the priorities required by the latest updating of the official schedule.
2. At the bi-weekly scheduling meeting, the Owner and Architect shall review the bar charts for the preceding two (2) weeks and the contractor shall report the progress actually achieved for each activity, which was scheduled to be performed during the two (2) weeks, including the actual dates on which the work was performed. The contractor agrees that this information shall constitute the official historical record of project progress. At each bi-weekly scheduling meeting, the contractor shall document any current delays to work operations. In addition, the contractor shall provide any available information regarding any potential delays, which they anticipate; i.e., procurement delays, expected strikes, etc.
3. Following the bi-weekly scheduling meeting, the Contractor shall issue to the Owner and Architect a new set of bi-weekly bar charts as developed at the meeting, which shall constitute the construction schedule for the upcoming two (2) weeks. The Contractor shall also issue a narrative bi-weekly progress analysis documenting progress achieved during the preceding two (2) weeks and analyze delays reported to constitute current or anticipated impacts to timely construction. The revised bar chart schedule and progress narrative shall agree with the meeting minutes and items discussed and agreed to at the bi-weekly meeting.
4. The contractor shall be represented at the bi-weekly scheduling meeting by their Construction Manager who shall have complete authority to provide the information required for the development of the next two (2) weeks bar chart schedule, documentation of past progress and documentation of delays. The contractor representatives shall also be authorized to discuss correction action planned to overcome delaying conditions at these meetings.

3.7 DAILY REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at the Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.

14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial Completions and occupancies.
19. Substantial Completions authorized.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents prepare and submit a detailed report. Submit with requests for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

END OF SECTION 013200

SECTION 013300 SUBMITTAL PROCEDURES

PART 1 - PRODUCTS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, General Conduct of the Work, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section augments requirements set forth in the General Conditions and specifies administrative and procedural requirements for submittals required for performance of the Work, including:

1. Contractor’s Use of Architect’s CAD Files.
2. Shop Drawings.
3. Product Data.
4. Samples.
5. Informational Submittals.
6. Delegated Design.

B. Administrative Submittals: Refer to General Conditions, other Division 01 Sections and other Contract Documents for requirements for administrative submittals. Such submittals included, but are not limited to:

1. Permits.
2. Contractor’s Construction Schedule.
3. Submittal Schedule.
4. Schedule of Values.
5. Applications for payment.
6. List of Subcontractors.

C. Related Sections include the following:

1. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
2. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
3. Division 01 Section "Closeout Procedures" for submitting warranties.
4. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
5. Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.
6. Divisions 2 through 48 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect and Construction Manager's responsive action.

B. Informational Submittals: Written information that does not require Architect and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements.

C. Concurrent Review: Simultaneous review by Architect and other discipline(s).

D. Shop Drawings: Original fabrication drawings.

E. Product Data: Manufacturer’s standard product literature and samples.

1.4 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Submittals Schedule: Comply with General Conditions and other requirements of the Contract Administration Division. A submittal schedule will be developed by the Contractor within 10 working days of Notice to Proceed and approved by the Architect within 10 working days after receipt for review.

1. **Follow the submittal requirements listed in this Section and elsewhere throughout the Contract Documents however and in addition to submittals required in other specification sections, one (1) copy of all HVAC, sprinkler, plumbing, electrical, and control system submittal must be forwarded to the Owner’s Project Manager. At minimum, for submittals other than those listed under this item a transmittal must be forwarded to the Owner’s Project Manager.**

C. Contractor shall record all submittal information on the required “Submittal Log”. Distribute Log at each progress meeting.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 10 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 5 working days for review of each resubmittal.
4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 10 working days for initial review of each submittal. Submittal will be returned to Contractor, through Architect. Submittals in the following sections require concurrent consultant review:

    a. Division 03: All Sections.
    b. Division 05: Sections 05120 “Structural Steel”, 05310 “Steel Deck”, 05300 “Steel Joists.
    c. Division 09: Acoustic Sections
    d. Division 13: All Sections.
    e. Division 15: All Sections.
    f. Division 16: All Sections.

5. Concurrent Transmittal to Consultant: Where indicated above and acceptable to Architect, Contractor may transmit submittals directly to Architect’s consultants in the required number of copies, while at the same time transmitting two additional copies of the entire submittal including the transmittal to the Architect.
6. Concurrent Transmittal to Owner:

    a. Transmit two (2) additional copies of all shop drawings, product data and coordination drawings and coordination drawings and one (1) set of each sample submittal to Owner’s Project Manager.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.

        1) Architect will assign own numbers to each submittal, which may be different than those assigned by the Contractor.

    i. Number and title of appropriate Specification Section and Keynote reference where applicable.
    j. Drawing number and detail references, as appropriate.
    k. Other necessary identification.

F. Deviations: Encircle or otherwise specifically identify deviations from the Contract

Documents on submittals.

1. No deviation or substitutions will be considered without a credit value, and subsequent approval from the Owner's Project Manager.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit specified number of copies of submittal to concurrent reviewer in addition to one complete copy and transmittal to Architect.
2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Submittal and transmittal distribution record.
k. Remarks.
l. Signature of transmitter.

2. On the transmittal record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's Certification that information complies with Contract Document requirements.

I. Contractor's Certification: All scale and full-size shop, erection or setting drawings, roughing drawings, sleeve and opening drawings, product data, and samples shall be examined and checked by qualified technical employees of Contractor as to accuracy, completeness and compliance with all contract documents prior to submission to the Architect for his review. These drawings, data and samples shall be stamped and signed by Contractor certifying to such examination and compliance. Any drawings, data and samples not checked, stamped, and signed by Contractor will be returned unchecked, to Contractor. Contractor will be held responsible for any delay in the progress of the work due to his failure to observe these requirements, and the time for the completion of his contract will not be extended on account of his failure to submit drawings, data and samples promptly in accordance herewith.

J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of

revision.

3. Resubmit submittals until they are marked “No Exceptions Taken", or “Make Corrections Noted”.

K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and authorities having jurisdiction, and others as necessary for performance of construction activities. Furnish one (1) copy of final submittals to Owner. Show distribution on transmittal forms.

L. Use for Construction: Use only final submittals with mark indicating "No Exceptions Taken” or “Make Corrections Noted” by Architect.

M. In instances where sepias, shop drawings and/or erection of drawings of a scale larger than the contract drawings are prepared by a contract, such drawings and sepias will be accepted in lieu of marked-up contract drawings provided they are updated according to the contract documents. A master sheet of the same dimensions as the contract drawings shall be prepared by the contractor on a tracing which shall indicate, sheet by sheet, a cross-reference to all shop drawings pertaining to that drawing. All drawings and sepias as required by Section 2.8 F below, shall be labeled "as-built" and dated above the tile block.

1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: Architect may provide electronic copies of CAD files of the Contract Drawings for Contractor’s use in preparing submittals subject to execution by the Contractor of a waiver and payment to the Architect for this service in the amount of $250. In accordance with the language of the waiver, the agreement is non-transferable by the Contractor to any Subcontractor, from any Subcontractor to the Contractor or from any Subcontractor to another Subcontractor. A separate waiver and payment is required for each individual contractor or subcontractor requesting electronic copies of CAD Drawings.

1. This service is not available prior to the award of the contract.
2. Architect’s consultants may or may not provide CAD files under the above agreement. Such consultants reserve the right to refuse to provide CAD files, regardless of whether or not the aforementioned waiver and fee agreement is executed. Consultants may, if they agree to provide CAD files, attach additional conditions to those listed above and below. Architect’s consultants include the following disciplines: civil, landscape, structural, mechanical, electrical, plumbing, and fire protection. Architect will advise Contractor if any consultants will not provide CAD files prior to executing above agreement.
3. CAD files will be provided in AutoCad 2020 format or newer version only.
4. CAD files will be provided in Architect’s office standard conventions for file structure, file names, layering standards, drafting standards, etc. Architect will not make revisions to these standards for the convenience of the Contractor.
5. CAD files may or may not contain differences from the Contract Documents, including work and information related, but not limited to, alternate designs, obsolete designs, addenda, bulletins, construction sketches, and informational sketches. Such differences may or may not be clearly indicated. Where such differences are found, they do not supersede the Contract Documents.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. When the following are specified in individual sections, submit them for review:

1. Shop drawings.
2. Samples for selection.
3. Samples for verification.
4. HVAC Test and Balance Reports.

C. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

D. Architect will consult with the Owner prior to rendering a decision or approval.

2.2 PRODUCT DATA

A. Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples. Each item of materials listed shall be marked “as specified” or “unspecified” as the case may be.
5. Number of Copies: Submit one original and three copies. For color charts submit four original color charts. One original and one copy will be returned. Reproduction for distribution to subcontractors, manufacturers, fabricators and suppliers is the responsibility of the Contractor.

a. Concurrent Submittals to Consultants: Submit one original and three copies to concurrent reviewer and two copies to Architect. In the case of color charts and

other non-reproducible information, submit four originals to concurrent reviewer and two original to Architect.

b. Concurrent Submittals to Owner: Submit one (1) copy.
c. Copy Owner with any transmittals for Product data sent to Architect or Consultants.

2.3 SHOP DRAWINGS:

A. Shop Drawings:

1. Shop Drawings are required all new work. Do not use Shop Drawings without an appropriate final stamp indicating action taken.
2. Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
3. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.
m. Relationship to adjoining construction clearly indicated.
n. Seal and signature of professional engineer if specified.
o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

4. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
5. Number of Copies: Submit one original (Contractor's option of bond print or correctable translucent reproducible print) and three additional copies. One original and one copy will be returned. Reproduction for distribution to subcontractors, manufacturers, fabricators and suppliers is the responsibility of the Contractor.

a. Concurrent Submittals: Submit one original and three copies to concurrent reviewer and two copies to Architect.
b. Concurrent Submittals to Owner: Submit one (1) copy to Owner
c. Copy Owner with any transmittals for Product data sent to Architect or Consultants.

6. Special Types of Shop Drawings:

a. Sleeve and Opening Drawings: Comply with requirements set forth in the General Conditions.

1) Comply with shop drawing requirements for submittal and review as specified in this Section.

b. Roughing Drawings: Furnish manufacturers certified roughing drawings, indicating accurate locations and sizes of all service utility connections, for machinery and equipment requiring such connections. Submit roughing drawings together with shop drawings for respective machinery and equipment.

7. Mechanical/Electrical Shop Drawing Minimum Requirements: Shop Drawings prepared by mechanical specialty trades shall comply with the following minimum requirements:

a. The accurate dimensions locate all horizontal ducts from column centerline. Locate all offsets, transitions, elbows, fire dampers, registers, grilles and diffusers.
b. All components shall be located to avoid recessed lighting, piping, conduits, cable trays and other in-plenum assemblies and where required shall be located so as to provide access to the component through removable ceiling material panels or access doors.
c. Vertical riser ducts shall be located and dimensioned from column centerlines in two (2) directions. Each vertical duct riser shall be shown in its total length when concealed inside of a shaft.
d. Each horizontal duct run shall be drawn to scale and size (width and depth noted) and an ELEVATION (bottom of duct) be clearly noted. This elevation shall clear all beams in the floor above and the ceiling construction below.
e. Sheet metal shop drawings shall be made using not less than ¼" scale per foot; increase scale as required in congested areas or as directed by the Contractor.

8. All piping, including fire protection, storm, sanitary, domestic, heating and cooling systems.

a. Give location of lines from column centerlines, indicate size, indicate centerline ELEVATION of piping and indicate drainage pitch as required.
b. Where a piping line is indicated locate centerline ELEVATION and pitch at intervals not to exceed twenty (20) feet.
c. Priority status shall be accorded preparation of dimensioned piping drawings for all piping below slabs-on-grade. Show all line pitches, critical inverts, in-slab fixtures as drains, floor sinks, troughs, cleanouts, etc. and outfall tie-in to site plumbing. Coordinate under slab piping with arrangement(s) of equipment furnished by others where applicable.

9. Electrical Trade:

a. Plan layouts, not less than ¼" scale, of transformer vaults, main electrical rooms, satellite electrical and/or communications closets, emergency generator spaces showing equipment to scale and locations thereof.
b. Main feeder distribution routing, horizontal and vertical sweep transitions to scale, of conduit over 1" showing ceiling plenum to scale.

10. Coordination:

a. Coordination of the work of the several trades and the fitting and routing of the

systems within concealed areas to avoid conflicts is the responsibility of the contractor(s). The Architect reserves the right to request coordinated drawings of congested areas showing all systems in plan and section to appropriate scale to insure the proper fitting of the work. The Contractor shall comply if so requested by the Architect.

b. Provide coordinated drawings of all main mechanical, electrical, communications, and other rooms listed below showing equipment required by all trades including structure, piping, hanger assemblies, HVAC ductwork, conduit, electrical devices, fire alarm devices, control centers, pipe grids, acoustic enclosures, other devices. Drawings dimensioned in both plan and section(s); not less than 3/8"=1'-0" scale.

2.4 COORDINATION DRAWINGS

A. Prepare and submit Coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components. See paragraph 2.3.9 above.

1. Show the interrelationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Refer to "General Provisions" Sections for specific Composite Drawing requirements for mechanical and electrical installations.

B. Role of Expediter: Contractor shall be responsible for expediting the preparation of the Coordination Drawings. Actual preparation of the drawings is described below. Contractor shall meet with subcontractors to develop a format for the Coordination Drawings (e.g. CAD, pin-register drafting, conventional drafting on Mylar using multiple pencil colors, etc.) such that reproductions obtained from the final Coordination Drawings can distinguish between the work of the various trades. Contractor shall resolve all conflicts arising in the coordination process.

C. Preparation Responsibility: Preparation of Coordination Drawings is the responsibility of the Contractor and all subcontractors principally involved. Production of the drawings shall proceed as follows:

1. HVAC subcontractor shall initiate the drawings by indicating his work, drawn at a scale of 3/8" per foot, showing dimensions, layouts, elevations and sections, all in relation to building construction (all steel structure, floor / roof slabs, ceilings, beams and columns).
2. Where applicable, the GWB subcontractor shall indicate the layout of all acoustic ceiling construction extent including all hanger devices and locations. AC ceiling construction indicated as well.
3. Fire Protection subcontractor shall then indicate the layout, sizes, dimensions and elevations of his work, using the HVAC subcontractor's drawings as a base, with dimensions in reference to fixed building construction.
4. Electrical subcontractor shall add his work to the base drawings begun by HVAC and Fire Protection subcontractors. Indicate locations and dimensions of light fixtures and electrical equipment conduit/cable-tray infrastructure, fire alarm equipment with reference to fixed building construction.
5. Plumbing subcontractor shall then add layouts, sizes and elevations of his work to the drawings of the above-mentioned trades, also dimensioned with reference to building structure.

D. Conflicts arising between the work of several trades shall be resolved between the respective trades, with the assistance of the General Contractor as expediter; and the drawings revised. Final Coordination Drawings shall be submitted by the Contractor to the Architect as required for submittals.

2.5 SAMPLES:

A. Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit three full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit four sets of Samples. Architect will retain one Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets

of paired units that show approximate limits of variations.

2.6 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. An officer shall sign certificates and certifications or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Coordination."

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

L. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.

2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

2.7 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

2.8 ADMINISTRATIVE SUBMITTALS

A. Contractor’s Construction Schedule: Comply with the General Conditions and other requirements of the Contract Administration Division.

1. If preliminary schedule requires revision after review, submit revised schedule within 5 business days.

2. Submit updated schedule with each Application for Payment.

B. Submittals Schedule: Comply with the General Conditions and other requirements of the Contract Administration Division.

1. Submit updated Submittal Log with each Application for Payment.

C. Application for Payment: Comply with the General Conditions and other requirements of the Contract Administration Division.

D. Schedule of Values: Comply with the General Conditions and other requirements of the Contract Administration Division.

E. Subcontract List: Comply with the General Conditions and other requirements of the Contract Administration Division. Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return two copies.

    a. Mark up and retain one returned copy as a Project Record Document.

5. Submit one (1) copy of initial subcontractor list to Owner within (10) business days after Owner's Notice to Proceed. No portion of the work shall be started until the Contractor has furnished the Owner with a list showing the sub-contractor and/or material supplier responsible for the portion of the actual work needing to be started. The list will be updated until the list reflects the complete group of all subcontractors, suppliers, vendors, etc. employed to carry out the work.

F. The contractor shall keep one (1) set of drawings on the project at all times which are to be marked "as-built". During the course of the project, they shall mark these drawings with colored pencils to reflect any changes as well as dimension, the location of all pipe runs, conduits, traps, footing depths or any other information not already shown on the drawings or differing there from. All buried utilities outside the building shall be located by a metes and bounds survey performed by a licensed surveyor who shall certify as to its accuracy. These marked-up drawings and surveys shall be made available to the contracting officer, the Construction Manager and the Architect/Engineer at any time during the progress of the work upon their request. These shall include the drawings of principal sub-contractors as well. The Owner's Project Manager as well as the Architect on a monthly basis as a prerequisite to the review of the contractor's payment applications will review as-built drawings.

2.9 SUBMITTALS FOR PROJECT CLOSE OUT

A. When the following are specified in individual sections, submit them at project closeout:

1. Project record documents.
2. Operation and maintenance data
3. Warranties.
4. Bonds (if and when required by the Owner).
5. Other types as indicated.

B. Manufacturers' Instructions, Product Literature, Certificates, and Reports.

1. All instructions, literature, certificates, test reports, other technical data and correspondence shall be submitted in four (4) copies. The Owner shall retain Two (2) copies, and the other two (2) returned to the Contractor.

C. Written Certifications

1. Provide written certifications where required, in the following formats:

a. Manufacturer's Written Certifications: Shall be submitted in letter form on the manufacturer's letterhead, signed by an authorized representative, indicating that all required components and elements of their manufacture are in conformity with the requirements so stated under the individual sections of these Specifications. Technical data, additional support material, or other information may be submitted with the certification letter.
b. Installer's Written Certifications: Shall be submitted in letter form on the installer's company letterhead, signed by a legal authorized company officer, indicating that their respective installation and/or Work are in conformity with the requirements so stated under the individual sections of these Specifications.

D. Submit all of the above items in this Section for the Owner's benefit during and after project completion.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect. The Architect / Consultants will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Final Unrestricted Release: When submittals are marked "No Exceptions Taken" (NET), that part of the Work covered by the submittal may precede provided it complies with requirements of the Contract Documents; final acceptance will depend upon compliance.
2. Final-But-Restricted Release: When submittals are marked "Make Corrections Noted" (MCN), that part of the Work covered by the submittal may precede provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
3. Returned for Resubmittal: When submittal is marked "Amend and Resubmit" (AR), do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

a. Do not permit submittals marked "Amend and Resubmit" to be used at the

Project site, or elsewhere where Work is in progress.

4. Disapproved for Non-Compliance: When submittal is marked “Rejected - See Remarks” (R), Architect’s explanation for rejection will be included. Do not proceed with the work. Prepare a completely new submission.
5. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked “Action Not Required”.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

F. Architect's Review: Review of shop and setting drawings, roughing drawings, sleeve and opening drawings, product data and samples by Architect will be a general review for conformance with design concept and compliance with information given in contact documents only, and shall not relieve Contractor of responsibility for accuracy of such submissions, nor for proper fitting, construction of work, or for furnishings of materials or work required by the contract and not indicated on submissions. Field dimensions, fabrication details, and job fitting are entirely Contractor's responsibility. Review shall not be construed as approving departures from contract requirements. Any proposed deviations from contract requirements, together with Contractor's explanations thereof, shall be stated in the letter of transmittal. Approval of a specific item shall not indicate approval of an entire assembly of which the item is a component. Should contractor check and certify submissions which indicate changes or deviations from the contract documents, and such changes are found acceptable to Architect, any and all additional costs resulting therefrom, including any cost for changes required to adjacent work or the work of other trades shall be the sole responsibility of Contractor.

END OF SECTION 013300

SECTION 014000 - QUALITY CONTROL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, general conduct of the Work and Special Requirements, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1. In Divisions 01 through 48 Sections:

a. The term "Architect" shall be synonymous with the term “Professional”.
b. The terms “Subcontractor”, “Sub-subcontractor”, “Installer”, “Applicator”, “Erector” and similar terms are synonymous with the term “Trade Contractor”.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality-control services.

B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to fabrication and installation procedures.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

E. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 01 Section "Coordination".
2. Division 01 Section "Testing and Inspections".
3. Division 01 Section "Testing Laboratory Services".
4. Testing by the Contractor of installed materials and equipment is specified in the Technical Sections (Divisions 02 through 48) of these Specifications.

F. Testing requirements for real property installed equipment (RPIE) to be furnished by the contractor when such testing is required by code, contract or the manufacturer shall be performed in a pre-approved testing laboratory or in the absence of such by the

manufacturer or its authorized representative at its place of business. The contractor shall provide a five (5) days' notice to the University and Architect/Engineer through the Owner's Project Manager. The University and the Architect/Engineer shall have the right to witness all tests.

G. The contractor will hire and pay for a qualified testing agency.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 RESPONSIBILITIES

A. **Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and/or required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.**

1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are to be done these services will be the Contractor's responsibility. The Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.

B. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements. The contractor shall pay for all costs including administrative cost incurred by the University.
2. When the University and/or Architect/Engineer require special or additional inspections, testing or approvals due to Contractor's failure to comply with contract specifications, industry standards, good building practices, any applicable code procedures including but not limited to ASIC, ASTM, etc., whether or not testing is

required by the contract documents for any individual component, entire system or process, the Contractor will secure the service of such special or additional inspections, testing or approvals. In the event such special or additional inspections and testing reveal a failure of the work to comply with the terms and conditions of the contract, the contractor shall also bear all costs necessary to repair or replace the work as required by the Architect/Engineer.

C. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the Work.
2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
4. Provide facilities for storage and curing of test samples.
5. Deliver samples to testing laboratories.
6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
7. Provide security and protection of samples and test equipment at the Project Site.

D. Duties of the Testing Agency: The independent agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Architect, the Contractor and the Owner in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Architect, the Contractor, and the Owner promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
3. The agency shall not perform any duties of the Contractor.

E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.5 SUBMITTALS

A. Submit a certified written report of each inspection, test, or similar service.

1. Distribute copies of each report to Owner, Architect and Engineer. Distribution of reports shall be made promptly, upon the completion of each test or inspection. **A field report will be distributed to the Owner's Project Manager prior to the Inspector leaving the jobsite on any day during which a test or inspection has been done. A final inspection report will be required from the inspection agency to all parties within five (5) business days following the inspection. Test reports will be required within (5) business days following the actual test date.**
2. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

3. Report Data: Refer to specification sections of Divisions 02 through 48 for submittal requirements applicable to inspection and test reports. In general, each report shall include:

    a. Date of issue.
    b. Project title and number.
    c. Name, address, and telephone number of testing agency.
    d. Dates and locations of samples and tests or inspections.
    e. Names of individuals making the inspection or test.
    f. Designation of the Work and test method.
    g. Identification of product and Specification Section.
    h. Complete inspection or test data.
    i. Test results and an interpretation of test results.
    j. Ambient conditions at the time of sample taking and testing.
    k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
    l. Name and signature of laboratory inspector.
    m. Recommendations on retesting.

4. All submittals of inspections and test reports or requests for approval shall be accompanied by a certification signed by the contractor attesting to his/her knowledge of the submittal, acceptance of its findings and acknowledgement that material tested meets the required standards and certify the report's representation of the facts. Failure to provide the written certification shall be grounds for rejection of the submittal.

1.6 QUALITY ASSURANCE

A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.
2. Each independent inspection and testing agency engaged on the Project shall be pre-qualified by the Division of Building and Construction of the State of New Jersey to perform the types of tests and inspections required.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 REPAIRS AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes.

1. Comply with Contract Document requirements for Division 01 Section "Cutting and Patching."

2. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
3. Restore patched areas and extended restoration into adjoining areas in a manner that eliminates evidence of patching.

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 014000

SECTION 014100 - TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 RELEATED DOCUMENTS

A. Drawings and general provisions of the contract, including general conditions, general conduct of the work and special requirements, and other Division 01 specification sections, apply to this section. In the event of any conflicts between the requirements of these sections, the more stringent requirement shall apply.

1.2 SECTION INCLUDES

A. Selection and payment.

B. Contractor submittals.

C. Laboratory responsibilities.

D. Laboratory reports.

E. Limits on testing laboratory authority.

F. Contractor responsibilities.

1.3 RELATED SECTIONS

A. General Conditions: Inspections, testing, and approvals required by public authorities.

B. Individual Specification Sections: Inspections and tests required, and standards for testing.

C. Drawings and general provisions of the Contract, including General Conditions, General Conduct of the Work and Special Requirements, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these sections, the more stringent requirement shall apply.

1.4 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM): ASTM C802 - Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction.

B. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

C. ASTM D290 - Recommended Practice for Bituminous Mixing Plant Inspection.

D. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

E. ASTM D4561 - Practice for Quality Control Systems or an Inspection and Testing Agency for Bituminous Paving Materials.

F. ASTM E329 - Practice for Use in the Evaluation of Inspection and Testing Agencies as Used in Construction.

G. ASTM E548 - Practice for Preparation of Criteria for Use in the Evaluation of Testing Laboratories and Inspection Bodies.

H. Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E6.

1.5 SELECTION AND PAYMENT

A. Contractor shall employ and pay for services of an independent Testing Laboratory, and Balancing Laboratory/Organization, approved by Owner and Architect/Engineer, to perform all specified inspecting and testing.

B. Employment of testing laboratory in NO WAY relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

1.6 QUALITY ASSURANCE

A. Comply with requirements of ASTM C802, ASTM C1077, ASTM D290, ASTM D3740, ASTM D4561, ASTM E329, ASTM E548, and ASTM E699.

B. Testing Laboratory Qualifications: Shall have been inspected by a nationally recognized inspection agency, acceptable to Owner and Architect/Engineer. Evidence of such inspection and current status shall be provided to Owner and Architect/Engineer. In addition, the approved lab shall document participation in a nationally recognized soils and concrete reference testing program during the twelve (12) months preceding the start of work on this project. Results of reference testing shall indicate an acceptable rating for the laboratory to be considered by the Owner and Architect/Engineer.

C. Laboratory: Authorized to operate in the State in which Project is located.

D. Laboratory Staff: Maintain a full time registered Professional Engineer on staff to review services.

E. Testing Equipment: Shall be calibrated at reasonable intervals with devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.7 CONTRACTOR SUBMITTALS

A. PRIOR TO START OF WORK, submit testing laboratory name, address, and telephone number, and names of full time registered Engineer and responsible officer.

B. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

1.8 LABORATORY RESPONSIBILITIES

A. Test samples of required items submitted by Contractor.

B. Provide qualified personnel at site. Cooperate with Architect/Engineer and Contractor in performance of services.

C. Perform specified inspecting, sampling, and testing of Products in accordance with specified standards.

D. Ascertain compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify Architect/Engineer and Contractor of observed irregularities or non-conformance of Work or Products.

F. Perform additional inspection and tests required by Architect/Engineer.

1.9 LABORATORY REPORTS

A. After each inspection and test within five (5) business days, promptly submit three (3) copies of laboratory report to Owner, Architect/ Engineer, and to Contractor. Include:

1. Date issued
2. Project title and number
3. Name of inspector
4. Date and time of sampling or inspection
5. Identification of product and specifications section
6. Location in the Project
7. Type of inspection or test
8. Date of test
9. Results of tests
10. Conformance with Contract Documents.

B. When requested by Architect/Engineer, provide interpretation of test results.

1.10 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory MAY NOT release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Laboratory MAY NOT approve or accept any portion of the Work.

C. Laboratory MAY NOT assume any duties of Contractor.

D. Laboratory HAS NO authority to stop the Work.

1.11 CONTRACTOR RESPONSIBILITIES

A. Deliver to laboratory at designated location, adequate samples of materials proposed to be used, which require testing.

B. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.

C. Provide incidental labor and facilities:

1. to provide access to Work to be tested,
2. to obtain and handle samples at the site or at source of Products to be tested,
3. to facilitate tests and inspections,
4. to provide storage and curing of test samples.

D. Notify Architect/Engineer, Owner and laboratory 24 hours prior to expected time for operations requiring inspecting and testing services.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 014100

SECTION 014200- REFERENCE STANDARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, General Conduct of the Work and Special Requirements, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 DEFINITIONS

A. General: Basic contract definitions are included in the Conditions of the Contract.

B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.

C. “Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases, unless any item associated with these terms will result in a monetary change order to the project. If the items associated with these terms require a change order the Owner must be notified prior to any action being taken.

D. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, and the Architect's and Owners duties and responsibilities are limited as specified by the Conditions of the Contract.

E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conversations and agreements within the construction industry that control performance of the Work.

F. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
2. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name. However, work resulting from any construction activity performed by a "Trade" must meet all quality standards acceptable to the Architect and Owner

J. "Project site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as past of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

L. If Requested: If requested by the Owner.

M. Where: Where or when practicable in the judgment of the Owner.

N. Satisfactory: Acceptable in the judgment of the Owner.

O. As Required: As required by the Architect, or as field conditions dictate.

P. Replace: To remove an existing product or service, and furnish and install an indicated product in its place.

Q. Specifications: The total and complete specifications of this Project as identified by the Architect, and the Architects consultants through the Architect, including referenced standard specifications, the General Specifications and the Technical Specifications as indexed.

R. System/ Assembly: In the context of this Project, where a 'system' or an 'assembly' as indicated in the Specifications and/or Drawings, it shall consist of the sum of all the relevant pasts and/or materials specific to the use of the system or assembly indicated; installed complete, in place, and in working order. All said pasts and/or materials required for a complete system indicated, shall be supplied and installed as past of the Base Bid Price for a complete, proper, and fully functional installation, whether specifically detailed or not. All materials for the system or assembly shall be installed completely, all necessary connections to other construction shall be provided. Upon completion of this system or assembly, the sum of all the parts that constitute the make-up of this unit, shall function and/or operate properly according to its intended design.

S. Mandatory: Means as required by code, any Building Authority, and any and all governing laws. All mandatory requirements for construction shall be included in the Base Bid Price for the Project.

T. Functional: Items(s) installed that are to operate properly or as intended.

U. Typical: A condition, detail, or other item that is common to an identified system, assembly, or any other construction condition where the essential characteristics are the same.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the 48-division format and CSI/ICSC's "MasterFormat" numbering system.

B. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows.

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated, as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.

a. The Technical Specifications are of the abbreviated type and include incomplete sentences. Omissions of words or phrases such as "the Contractor shall"; "in conformance with"; "shall be"; "as noted on the Drawings"; "according to the Plans"; "a" "an"; "the"; and "all" are intentional. Omitted words and phrases shall be supplied by inference in the same manner, as they are when a "note" occurs on the Drawings. Works "shall be" "shall have", and "shall" will be supplied by inference where a colon (:) is used within sentences or phrases.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Section Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
b. Abbreviated references to trade associations, technical societies, recognized authorities and other institutions are included in the contract documents. Any abbreviation or organization not recognized by the Contractors shall be requested from the Architect for interpretation. Failure to request and receive an interpretation shall not relieve the Contractor from performing and/or supplying materials or workmanship in compliance with specified references to the satisfaction of the Architect or Owner

C. References: References to known standard specifications shall mean and intend the latest edition of such specifications adopted and published as of the date of the invitation to bid.

D. Divisions: Divisions of the specifications into sections is done for the convenience of reference and is not intended to control the Contractor in dividing the Work among subcontractors or to limit the scope of work performed by any trade under any section

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a past of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of the date of the Contract Documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the Architect for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding

D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

1.5 GOVERNING REGULATIONS AND AUTHORITIES

A. Copies of Regulations: Obtain copies of the following regulations and retain at the Project site to be available for reference by parties who have a reasonable need:

1. Any and all Federal, State or Local regulations required by the Agency having jurisdiction to be retained or posted at the project site

1.6 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 DRAWINGS

A. The Contractor shall provide all quantities, items, articles, materials, operations, or methods listed, mentioned, implied, scheduled, or specified, on the Drawings, including all labor, materials, equipment, and incidentals required for their completion.

B. Intent of the Drawings:

1. As with any plan, the Contractor shall be responsible for verifying all field conditions, whether or not noted in the plans prior to construction. Any discrepancies shall be resolved with the Owner prior to construction. The start of construction will not be delayed due to the Contractors need to verify all field conditions. Verification of items must be scheduled by the Contractor so as not to impede the progress of the work. The Contractor shall be responsible for correcting damage resulting from Contractor's failure to verify field conditions. Architect/Engineer and Owner liability for accuracy of survey information.
2. The implied intent of the Drawings, includes the overall layout of the Project, inclusive of site structures, site improvements, location of all items required during construction, the extent of construction and the extent of the materials.
3. All such Drawings and Specifications constitute the Project as a whole, and are as a result, directly related to one another. The Drawings and Specifications are not divided into, or are intended to be divided into separate entities according to building trades or local practice. It is the responsibility of the Contractor to disseminate all information represented on the Drawings and Specifications so that all trades and sub-trades will have complete and thorough knowledge of the Project intent. No requests for Change Orders, time extensions, or other considerations will be accepted if the Contractor fails to properly coordinate information to the various trades/sub-trades.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 014200

SECTION 014523 – TESTING AND INSPECTIONS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the testing and inspection requirements as specified herein.

1.3 RELATED SECTIONS

A. Requirements for testing and inspection shall be described in various Sections of these Specifications. Where no testing and inspection requirements are described but the Owner determines that it is necessary, the Owner may request additional testing and inspection to be performed at his own expense.

B. Work Not Included

1. Unless otherwise noted in this Section or other Section of work, the Owner will select a pre-qualified independent testing laboratory and inspection professional.
2. Unless otherwise noted in this Section or other Sections of work, the Owner will pay for all initial services of the testing laboratory and inspection professionals as further described in Article 2.1 of this Section of these Specifications.

1.4 QUALITY ASSURANCE

A. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E 329-14a "Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection."

B. Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

1.5 PRODUCT HANDLING

A. Promptly process and distribute all required copies of test reports and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay in progress of the work.

PART 2 - PRODUCTS

2.1 PAYMENTS FOR TESTING AND INSPECTION SERVICES

A. Initial Services: The Owner will pay for all initial testing and inspection services.

B. Retesting: When initial tests and inspections indicate non-compliance with local Codes and the Contract Documents, all subsequent retesting occasioned by the non- compliance shall be performed by the same testing laboratory and inspectors and the costs thereof will be deducted by the Owner from the Contract Sum.

2.2 CODE COMPLIANCE TESTING AND INSPECTION

A. Inspections and tests required by Codes or Ordinances, or by a plan approval authority, shall be paid by for by the Owner unless otherwise noted in this Section or other Sections of work. Retesting or inspection as required shall conform to the requirements of Article 2.1 B of this Section.

2.3 CONTRACTOR'S TESTING

A. Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

B. Where operating tests are specified, the Contractor shall test his work as it progresses, on his own account, and shall make satisfactory preliminary tests in all cases before applying for official tests.

C. Tests shall be made in the manner specified, for the different branches of the work. Each test shall be made on the entire system for which such test is required, wherever practical. In case it is necessary to test portions of the work independently, the Contractor shall do so without extra compensation. The Contractor shall furnish all labor, material and apparatus, make corrections and conduct the official test. The test will be conducted in the presence of a representative of the Architect.

D. All parts of the mechanical and electrical work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition. All defects disclosed by these tests shall be corrected to the satisfaction of the Architect and Engineer without any additional cost to the Owner. Tests shall be repeated on this repaired or replaced work if deemed necessary by the Architect. The Architect shall be notified at least forty-eight (48) hours in advance of all tests, and shall be represented at tests that he deems necessary. The Contractor shall furnish all necessary instruments, other equipment, and personnel required for such tests.

E. Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered by him to the Architect.

F. If the Architect or Engineer is to observe the inspections, tests or approvals required by the Contract Documents, he will endeavor to do so promptly and, where practicable, at the source of supply.

PART 3 - EXECUTION

3.1 COOPERATION WITH TESTING LABORATORY AND INSPECTORS

A. Representatives of the testing laboratory and inspectors shall have access to the work at all times. Provide facilities for such access in order that they may properly perform their functions.

3.2 SCHEDULES

A. Establishing Schedule: By advance discussions with the inspection service and testing laboratory selected by the Owner, determine the time required to perform inspections and tests and to issue each of its findings. Provide all required time within the construction schedule.

B. Revising Schedule: When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the inspectors and testing laboratory as required.

C. Adherence to Schedule: When the testing laboratory is ready to test according to the determined schedule but is prevented from testing or taking specimens due to incompleteness of the work, all extra costs for testing attributable to the delay will be back-charged to the Contractor.

3.3 TAKING SPECIMENS

A. All specimens and samples for testing, unless otherwise provided in these Contract Documents, will be taken by the testing laboratory; all sampling equipment and personnel will be provided by the testing laboratory; and all deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

END OF SECTION 014523

SECTION 015000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection. Temporary utilities include, but are not limited to, the following:

1. Temporary water service and distribution.
2. Temporary electric power and light.
3. Temporary heat.
4. Telephone service.
5. Sanitary facilities, including drinking water.
6. Storm and sanitary sewer.

B. Support facilities include, but are not limited to, the following:

1. Field offices and storage sheds.
2. Temporary roads, paving and truck wash-down station.
3. Dewatering facilities and drains.
4. Temporary enclosures.
5. Hoists.
6. Temporary project identification signs and bulletin boards.
7. Waste disposal services.
8. Rodent and pest control.
9. Construction aids and miscellaneous services and facilities.

C. Security and protection facilities include, but are not limited to, the following:

1. Temporary fire protection.
2. Barricades, warning signs, and lights.
3. Sidewalk bridge or enclosure fence for the site.
4. Environmental protection.

D. The Contractor is responsible for all costs associated with the supply, maintenance or usage of temporary utilities and construction related facilities unless indicated otherwise in this Section.

1.3 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. Building code requirements.

2. Health and safety regulations.
3. Utility company regulations.
4. Police, fire department, and rescue squad rules.
5. Environmental protection regulations.

B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

C. Provide waste removal services as required to maintain the site in a clean and orderly condition.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to the Owner, the Contractor may use undam- aged, previously used materials in serviceable condition. Provide materials suitable for use in- tended.

B. Paint: Comply with requirements.

1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and ply- wood, provide exterior-grade acrylic-latex emulsion over exterior primer.
2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.

C. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

D. Water: Provide potable water approved by local health authorities.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Owner, the Contractor may use undam- aged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4-inch, heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where ex- posed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage.

F. Fire Extinguishers: Provide hand-carried, portable, UL-rated; Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work and the areas adjacent to the Work area. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Prior to temporary utility avail- ability, provide trucked-in services.
3. Obtain easements to bring temporary utilities to the site where the Owner's

easements cannot be used for that purpose.

4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner. Neither the Owner will accept cost or use charges as a basis of claims for Change Orders.
5. Install services to cause minimum disruption to area's adjacent to the work area.
6. Add provisions for work not in Contract but served by temporary facilities, if required.

B. Water Service: Contractor may use existing water service in the area of work.

C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switchgear. **Cost of temporary electric power usage is the Contractors responsibility. Cost shall be included in the bid.**

D. Initial temporary service shall be three (3) phase, or single phase. Temporary light and power installations, wiring and miscellaneous electrical hardware must meet the electric code. Electrical characteristics shall be provided to meet all temporary light and power reasonably required as herein and hereinafter specified or as included under the general conditions. The contractor shall pay the cost of running temporary services. **All costs shall be included in the bid.**

1. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic-sheathed cable where overhead and exposed for surveillance.

E. Power outlets shall be fed independently of the temporary lighting system. The extension of service shall include the necessary wiring of sufficient capacity to the location of the well for the operation of the well pump in the event a water well is the source of water supply for the project. Where service of a type other than herein mentioned is required, the contractor requiring it shall pay all costs of such special service.

F. Temporary Lighting: Provide temporary lighting with local switching. **Cost of temporary lighting usage is the contractors' responsibility. Cost shall be included in the bid.**

1. The contractor shall provide double sockets at a maximum of thirty feet (30') on centers in large areas. One (1) socket shall contain a 150-watt lamp and the other socket shall be a grounding type to accept a receptacle plug for small, single-phase loads to be used for short periods of time.
2. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

G. The contractor shall observe the requirements of the Federal Occupational Safety and Health Act (OSHA) of 1970 with regard to temporary light and power.

H. Temporary Heat: Provide temporary heat required by construction activities. Select safe equipment that will not have a harmful effect. **Any cost associated with the supply, maintenance and usage of temporary heat will be the responsibility of the contractor. Cost of temporary heat shall be included in the bid.**

I. Use of gasoline-burning space heaters, open flame, or salamander heating units is

prohibited.

J. Should electricians be required to supervise and maintain equipment required for the provision of heat, the payment for the services of the supervisors and/or maintenance personnel shall be the responsibility of the Contractor. The contractor shall pay the cost of all fuel consumed in the operation of the generating unit for supplying temporary heat.

K. All heating equipment shall be NFPA approved. Heaters shall be approved by a recognized testing laboratory and must be equipped with a positive shut-off safety valve. Notwithstanding the above, all temporary heating equipment will comply with all Federal and State laws and regulations.

L. Temporary Telephones: Contractor shall utilize their own cell phones for service.

M. The contractor may utilize the Owner's sanitary/wash facilities, drinking water, etc. if these amenities are available. The contractor shall only use these facilities with Owner's permission. The contractor will be responsible to reimburse the Owner for all Owner provided utilities use by the Contractor. Further, should the contractor elect to utilize Owner provided utilities the contractor will be responsible to repair all damage and replace all damaged items before the project will be considered substantially completed. The Owner will not be required to make final payment to the contractor until such damage is repair or replaced to its original or better than original condition.

3.3 SUPPORT FACILITIES INSTALLATION

A. Temporary storage sheds are not permitted on the Owner's property.

B. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

1. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.

C. Temporary Lifts and Hoists: Contractor may utilize the existing elevator for bringing materials to the area of work and disposing materials to the area of work provided that:

1. The Contractor provides temporary protection materials, padding, etc. for the elevator cab.
2. The Contractor observes the weight capacity of the existing elevator cab.
3. The Contractor is only permitted to use the existing elevator from the hours of 9:00 p.m. to 6:00 a.m. Monday through Friday.
4. The Contractor notify the Owner of the elevator use three (3) business days prior to use.

D. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.

1. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.

E. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere

daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

1. Provide containers with lids. Dispose of waste off-site periodically.

F. Individual Project circumstances may require use of other construction aids and miscellaneous facilities, such as walkways, scaffoldings, platforms, swing stages, ramps and bridges, incidental sheeting and shoring, demolition waste chutes, and similar construction aids. Add requirements as necessary to suit Project.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stair- well.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

B. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

C. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

D. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Re- strict use of noise-making tools and equipment to hours that will minimize complaints from per- sons or firms near the site.

1. No burning will be permitted on the site.
2. It will be the Contractor’s responsibility to control dust by a means acceptable to the Owner. The Contractor shall make due allowance in his bid to cover these non-productive costs.

E. Protection of Utilities:

1. The Contractor shall exercise special care when working near existing utility installations such as lights, ducts, structures, underground trench laid cables, cable markers, pads, water lines, underground oil lines, railroads and other installations, to ensure that no damage is done to them and that the underground wiring to such utilities is not damaged or rooted out, or pipelines broken or punctured.
2. If the Contractor damages any installation, the Contractor shall repair at no cost to the Owner the damaged item to the Owner's satisfaction. At the Owners discretion, repairs will be done continuously on a 24-hour per day basis until completed. The Contractor shall submit for approval the name of an electrical contractor and a plumbing contractor who shall be available on a 24 hour a day basis to affect any repairs as may be necessary due to Contractor error.
3. The Contractor shall obtain (if available) as-built site underground information prior to beginning excavation to minimize the possibility of interruption or damage to existing facilities. The lack of this information shall not excuse damage to the utilities by the con- tractor or the requirement to make necessary repairs immediately, the Contractor shall pay for Cost of the repair work.

F. Protection and Restoration of Property and Landscape: The Contractor shall be responsible for the preservation of all public and private property. All land monuments and property markers shall be preserved until the Owner has witnessed and recorded their location.

G. Protection of Existing Trees, Shrubs, and Vegetation to Remain: Contractor shall take all means necessary to protect existing trees, shrubs, and vegetation. Contractor and its forces shall abide by the boundaries set by the Drawings for the protection of root systems of all designated trees, shrubs and vegetation. Protection shall be completely in place prior to the start of construction work in any area. Contractor shall clearly mark all restricted areas as indicated on the Drawings and prevent the use of the area by all personnel and equipment until final cleanup.

H. Project Security:

1. The Contractor shall be responsible for monitoring all personnel requiring access to the work site including his personnel, subcontractor's personnel, other contractors working in the same construction area, material delivery trucks, authorized visitors to the site, etc.
2. The Contractor shall be held responsible for the security and protection of its own, sub- contractors and sub-subcontractors equipment, vehicles, trailers, tools, materials, and all other items necessary for the work under this Contract.
3. The Contractor shall be held responsible for the admission of any unauthorized personnel into his work area.
4. In general, provide security and facilities to protect Work, existing facilities, and the Owner's operations from unauthorized entry, vandalism or theft.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from dam- age by freezing temperatures and similar elements.

1. Protection: Prevent water-filled piping from freezing. Maintain markers for

underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Owner requests that it be maintained longer, remove each temporary facility when the need has ended or no later than Substantial Completion. Complete or, if necessary, restore existing permanent construction that may have been damaged as a result of the use, maintenance or operation of temporary facility for this project. Repair damaged new work, repair or replace, as directed by the Owner, existing work and or conditions, clean ex- posed surfaces, and replace construction that cannot be satisfactorily repaired as a result of the use, maintenance or operation of temporary facilities for the project.

1. Where the area is intended for future landscape development, remove any material, equipment, debris, trash, soil and aggregate fill used as part or in conjunction with the project that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks damaged during and as a result of work conducted as part of this project. Replace and/or repair as required and direct by the governing authority and the Owner.

END OF SECTION 015000

SECTION 016000 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete product requirements as specified herein, including, but not limited to, the following:

1. Product delivery, storage and handling.

2. Storage and protection.

3. Identifying markings.

4. Temporary use of equipment.

5. General standards.

1.3 RELATED SECTIONS

A. Substitution Procedures - Section 012500.

B. Execution Requirements - Section 017300.

1.4 TRANSPORTATION AND HANDLING

A. Materials, products, and equipment shall be properly containerized, packaged, boxed, and protected to prevent damage during transportation and handling.

B. More detailed requirements for transportation and handling are specified under the technical Sections.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft,

and other losses.

3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 IDENTIFYING MARKINGS

A. Name plates and other identifying markings shall not be affixed on exposed surfaces of manufactured items installed in finished spaces.

1.7 PRODUCT APPROVAL STANDARDS

A. Where the words "or approved equal" or other synonymous terms are used, it is expressly understood that they shall mean that the approval of any such submission is vested in the Architect, whose decision shall be final and binding upon all concerned. All submissions are subject to such approval and shall conform to the requirements of Article 1.8 herein.

1.8 TEMPORARY USE OF EQUIPMENT

A. No equipment intended for permanent installation shall be operated for temporary purposes without the written permission of the Architect.

B. The temporary or trial usage by the Owner of any mechanical device, machinery, apparatus, equipment or any work or materials supplied under this Contract before final completion and written acceptance by the Architect, shall not be construed as evidence of the acceptance of same by the Owner. The Owner shall have the privilege of such temporary and trial usage, for such reasonable length of time as and when the Architect shall deem to be proper for making a complete and thorough test of same and no claim for damage shall be made by the Contractor for the injury to or breaking of parts of such work which may be caused by weakness or inaccuracy of structural parts or by defective material or workmanship. If the Contractor so elects, he may at his own expense, place a competent person or persons to make such trial usage; such trial usage shall be under the supervision of the Contractor.

1.9 GENERAL REQUIREMENTS

A. In the event that it is necessary for the Contractor to store any materials offsite, he shall first obtain the approval of the Architect. The Contractor shall be responsible for insurance and warehousing charges of any materials stored offsite. The Contractor shall also be responsible for the cost of delivery to the job site of any materials that have been stored offsite.

B. Materials delivered to the job site shall be carefully stored and protected from damage. Damaged material shall not be used in the work. The Contractor shall provide, where directed temporary storage facilities as may be required for the storage of all materials which might be damaged by weather.

C. Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the representative manufacturers, unless otherwise specified.

D. Equipment, plant, and appliances, such as hoists, centering, concrete lifts, construction elevators, cranes, rigging, towers, derricks, walks, ramps, chutes, scaffolding, implements, transportation, cartage and other things necessary and required for the adequate execution of the work and as required by law and applicable Union rules shall be provided and shall be maintained in good and safe mechanical working order, be responsible for their safe use, and remove them when no longer required. Applicable requirements of OSHA shall become and form a part of this document.

E. During handling and installation of work at project site clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure freedom from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

F. To extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period. Such exposures include (where applicable, but not by way of limitation) static loading, dynamic loading, internal pressures, external pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.

G. Require installer of each major unit of work to inspect substrate to receive the work, and conditions under which the work will be performed, and to report (in writing to Contractor) unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

H. Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation to whatever extent these are more explicit or more stringent than applicable requirements indicated in the Contract Documents.

I. Inspect each item of materials or equipment immediately prior to installation and reject damaged and defective items.

J. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerance if not otherwise indicated. Allow for expansions and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual-effect choices to Architect for final decision.

K. Recheck measurements and dimensions of the work as an integral step of starting each installation.

L. Install work during conditions of temperature, humidity, exposure, forecasted weather, and status of project completion which will ensure best possible results for each unit of work in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.

M. Coordinate enclosure (closing-in) of work with required inspections and tests, so as to avoid necessity of uncovering work for that purpose.

N. Mounting Heights: Except as otherwise indicated, mount individual units of work at industry-recognized standard mounting heights, for applications indicated. In CMU walls mount units at height closest to manufacturer's recommendation so as to minimize cutting of block coursings. Refer questionable mounting height choices to Architect for final decision.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 016000

SECTION 017300 – EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. General installation of products.
2. Progress cleaning.
3. Starting and adjusting.
4. Protection of installed construction.
5. Correction of the Work.

1.3 RELATED SECTIONS

A. Cutting and Patching - Section 017329.

B. Closeout Procedures - Section 017700.

1.4 SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg. F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.5 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 014000, "Quality Requirements."

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide continuous protection during construction of all finishes, including taped Masontie joints, and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.1 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Section 017329, "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly.

E. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017700– CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project record document submittal.
3. Operation and maintenance manual submittal.
4. Submittal of warranties.
5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Drawings.

1.3 SUBSTANTIAL COMPLETION

A. Substantial Completion: The date of Substantial Completion for the Work, or designated portion thereof, is the date certified by the Architect when the construction is sufficiently complete, in accordance with the Contract Documents, so that the Owner may occupy the project, or the designated portions thereof, for the use for which it was intended PRIOR to the Mandatory Completion Date. Substantial Completion shall be accomplished and the full project and all designated portions thereof, read for use and occupancy by the Owner by the completion milestone deadline listed below. It shall be the responsibility of the Contractor to notify the Architect and Owner in not less than seven (7) calendar days prior to the Substantial Completion Milestone deadline for a “substantial completion” inspection. The University shall issue a Certificate of Substantial Completion (AIA Document G704) at the point in time when the inspection has been fully completed and the appropriate approvals and certificates have been granted by governing authorities and obtained by the Contractor.

1. IT IS THE INTENT OF THESE SPECIFICAITONS THAT SUBSTANTIAL COMPLETION IS ACHIEVED NO LATER THAN THE DATES AS OUTLINED IN SECTION 011000 “SUMMARY”**. THE CONTRACTOR MUST INCLUDE ANY AND ALL COSTS INCLUDING ANY OVERTIME NECESSARY TO ATTAIN SUBSTANTIAL COMPLETION BY THE DEADLINE LISTED IN SECTION 011000 BASED UPON BEING AWARDED THE PROJECT BY THE DATE LISTED IN SECTION 011000.**

B. **LIQUIDATED DAMAGES ARE PART OF THIS PROJECT. These will be assessed at the following rates:**

1. $3,000.00 per day beyond substantial completion until final completion.

C. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List items below that are incomplete in request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.

    a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
    b. If 100 percent completion cannot be shown, include a list of incomplete items (a project punch list), the value of incomplete construction, reasons the Work is not complete, and a timeline during which the work must be completed.

2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems and instruction of the Owner’s operation and maintenance personnel.
9. Disconnect and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
10. When mechanical, electrical or other equipment is installed, it shall be the responsibility of the contractor to maintain, warrant and operate it for such period of time as required by the contract documents or as necessary for the proper inspecting and testing of the equipment for adequately instructing the University's operating personnel. All costs associated with the maintenance, warranty, operations, inspection and testing of equipment in addition to instructing University personnel shall be borne by the contractor. All tests shall be conducted in the presence of and upon timely notice to the contracting officer, Owner’s Project Manager and Architect/Engineer prior to acceptance of the equipment.
11. Owner’s warranties will start at Final Acceptance of the Project.

D. Pre-final Inspection:

1. When the Contractor has completed all work and is satisfied the Project is in compliance with the Contract Documents, it will notify the Owner and Architect, in writing, that the Project is complete and ready for inspection. The Owner and Architect will arrange for and conduct an inspection of the Project by the Owner, Architect, Engineers and the Contractor. The Owner will be provided with a reasonable time to arrange for and conduct an inspection.

2. The Owner and Architect will document any deficiencies on a written punch list and will arrange a meeting with the Contractor to review the punch list, explain deficient items and designate a time frame in which the punch list must be completed. The Contractor will correct all the deficiencies within the designated time frame and notify the Owner in writing, when the Project is ready for re-inspection. The Owner will arrange and conduct the re-inspection of the Project to review the corrected items.
3. The formal list of deficiencies found shall not be considered a final list of all deficient items. Any deficiencies found during instructions to the Owner, inspection for Substantial Completion, beneficial occupancy, or inspection for final acceptance, the Contractor will correct all deficient items per the contract documents prior to final acceptance.

E. Substantial Completion:

1. Upon completion of deficient items and instruction to the Owner, the Contractor will arrange for an inspection of the Project with the Owner and the Architect. This inspection may result in a list of additional items to complete after occupancy, but before final payment and/or may require additional correction prior to occupancy by the Owner.
2. Upon formal notice from the Owner, the Contractor shall then arrange for the submission of all outstanding record documents, including: maintenance manuals, guarantees, warranties, maintenance contracts, and any additional instructions necessary for the operation of the project. The Contractor shall acquaint the Owner with acceptance tests, guarantees, warranties, and maintenance manuals. The Contractor shall also obtain a ‘Certificate of Occupancy’ or similar releases required to permit the Owner’s occupancy of the Project.
3. Should the instruction period find deficiencies, the Owner will notify the Contractor in writing of deficient items.
4. If the inspection confirms that the Project is ‘substantially complete’ and is ‘ready for occupancy’, the Owner through the Architect/Engineer will issue a “Certificate of Substantial Completion’. The Certificate will confirm that the Project can be occupied for its intended use. Attached to the Certificate will be any final punch list to be completed. Prior to issuance of the Certificate, the Contractor shall submit a schedule for completion of remaining deficiencies, approved or amended by the Owner.
5. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

    a. The Architect will repeat inspection when requested and assured that the Work is substantially complete.
    b. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 BENEFICIAL OCCUPANCY

A. Upon issuance of the ‘Certificate of Substantial Completion, the Owner may then occupy the Project (or the designated area of the Project).

1.5 FINAL ACCEPTANCE

A. Final Inspection: Upon completion of any remaining deficiencies the Contractor shall notify the Owner in writing, that the Project is complete and ready for final inspection. The Contractor shall arrange for and conduct the final inspection of the Project with the Owner.

B. Final Acceptance: If the final inspection indicates satisfactory completion of the Work, the Owner through the Architect/Engineer will issue a Change Order adjusting to the final quantities. Following acceptance of the final Change Order, receipt of required affidavits, final release of liens, consent of surety for final payment along with all other documentation required by the contractor documents, the Owner through the Architect will authorize a final Certificate for Payment.

1. Mandatory or Final Completion: Final Completion shall be accomplished and the full project, and all designated portions thereof, completed and ready for use without any further work required within the time frame identified for each phase of work from the date of issuance and as listed on the Certificate of Substantial Completion by the Architect.
2. The guarantee period for all materials, equipment and workmanship shall start on the date of 'Final Acceptance' unless otherwise noted on the Certificate.

C. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.
4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
5. Submit consent of surety to final payment.
6. Submit a final liquidated damages settlement statement.
7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

D. Re-inspection Procedure: The Architect will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Owner.

1. Upon completion of re-inspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, re-inspection will be repeated.
3. Should the Project require inspections beyond the inspections noted above, i.e. a pre-final and a final inspection only the Owner will reduce from the Contractor's final payment those monies necessary to provide for the cost of the additional inspections. The reduction shall not be considered as a part of any "Liquidated Damages' for failure to complete within the specified Contract Time. The reduction shall not be considered as a penalty to the Contractor; but shall be for the actual cost of monies required for the reimbursement of fees for the Architect, Engineers, Owner and any other specialists necessary for obtaining final approval of the Work.

1.6 EXCESSIVE DEFICIENCIES

A. During any inspection for Project completion, if it is determined by the Owner, that the Contractor has not sufficiently completed the Work in compliance with the Contract Documents, the Owner may declare that the Project is not sufficiently complete to continue the inspection of the Work. Within three (3) working days of this declaration, the Owner will issue in writing, a list of excessive deficiencies found. Upon receipt of the Owners notice of excessive deficiencies the Contractor will have ten (10) working days to remove such deficiencies. If such deficiencies have not been corrected in the time frame herein specified the Owner can at its' option complete the Work. Any costs incurred by the Owner as a result of its' assuming the responsibilities of the Contractor in this regard will be deducted from any monies remaining to be paid to the Contractor. Should the costs associated with the Owner having to assume responsibility for the work to correct excessive deficiencies exceed the amount of funds remaining to be paid the Contractor shall be liable to the Owner for the difference.

1.7 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.

1. **All of the record documentation listed herein shall be provided by the Contractor in hard copy and digitally. Digital copies shall be provided by the Contractor in PDF format, and issued to the Owner via CD. Hard copy shall be provided by the Contractor in an 8-1/2" x 11" binder.**

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
3. Note related change-order numbers where applicable.
4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.

1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
3. Note related record drawing information and Product Data.
4. Upon completion of the Work, submit record Specifications to the Architect for the

Owner's records.

D. Record Product Data: Maintain one copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.

1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.
2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
3. Upon completion of markup, submit complete set of record Product Data to the Architect for the Owner's records.

E. Record Sample Submitted: Immediately prior to Substantial Completion, the Contractor shall meet with the Architect and the Owner's personnel at the Project Site to determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the Owner's Sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Architect for the Owner's records.

G. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch (51-mm), 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

1. Emergency instructions.
2. Spare parts list.
3. Copies of warranties.
4. Wiring diagrams.
5. Recommended "turn-around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Fixture lamping schedule.

H. Roughing Drawings and Operating Manuals: Plumbing, HVAC, electrical and other machinery and mechanical equipment items requiring utility service connections shall have their respective shop drawings accompanied by manufacturer's certified roughing drawings indicating accurate locations and sizes of all service utility connections.

I. Sleeve and Opening Drawings: Prior to installing service utilities or other piping, etc. through structural elements of the building, the contractor shall prepare and submit accurate dimensioned drawings to the Construction Manager for approval of the Architect and/or Structural Engineer for approval indicating the positions and sizes of all sleeves and openings required to accommodate his/her work and installation of his/her piping, equipment, etc. and all with reference to the established dimensional grid of the building. Such drawings must be submitted in sufficient time to allow proper coordination with reinforcing steel shop drawings and proper placing in the field.

J. Control Valve and Circuit Location Charts and Diagrams: The contractor shall prepare a complete set of inked or typewritten control valve and circuit location diagrams, charts, diagrams and lists under frame glass in appropriate designed equipment rooms as directed. The contractor shall also furnish one-line diagrams as well as such color-coding of piping and wiring and identifying charges as specified or required. This information is to be framed under glass and installed where directed. The Contractor shall also provide the University a second complete set of the control valve and circuit location diagrams, charts, diagrams and lists not under glass.

K. Warranties:
1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within the (10) days after completion of the applicable item of work. Leave the date of beginning of time of warranty until the Date of Final Acceptance of the building and prior to receipt of final payment.
2. Make other submittals within ten (10) days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond the Date of Substantial Completion, submit within (10) days after written acceptance, listing the date of acceptance as the beginning of the warranty period. Final payment will not be approved until the Owner has received all warranties.
4. Warranty periods for all items installed as part of the Work under this Contract will start at 'Final Acceptance' of the entire scope of Work on the Project.
5. Co-execute submittals when required.
6. Warranty Manual: Bind all warranties and bonds in a commercial type 81/2" X 11" three D side ring binder with durable plastic covers.

    a. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of General Contractor and equipment suppliers; and name of responsible company principal.
    b. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of the product or work item.
    c. Transmit two (2) copies of the "Warranties Manual" to the University prior to submission of Final Application for Payment.

7. A certificate of Asbestos shall certify that no asbestos or asbestos-containing products are or have been installed as part of this project.

1.8 CLOSEOUT PROCEDURES

A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.
7. Identification systems.

8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Startup.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

C. Allow a minimum of three (3) hours training for all of the Owners personnel who will be involved with the maintenance or operation for each piece of equipment or system that requires any type of maintenance or operation.

D. For equipment, or component parts of equipment put into service during construction and operated by the Owner, submit completed documents within ten (10) days after written acceptance and prior to receipt of final payment.

E. The contractor shall submit the as-built documents to the Owner’s Project Manager for review by the Architect/Engineer whether altered or not with a certification as to the accuracy of the information thereon at the time of contract completion and before final payment will be made to the contractor. After acceptance by the Architect/Engineer, the contractor will furnish two (2) sets of all shop and/or erection drawings used for as-built documentation.

1. All as-built drawings as submitted by the contractor shall be labeled "as-built" and dated above the title block. This information shall be checked, edited and certified by the Architect/Engineer who shall then transpose such information from the contractor's as-built drawings to the original tracings and certify that such tracing reflect "as-built" status and deliver said tracings to the University. Where shop drawings have been used by the contractor for as-built documentation the tracing provided shall include cross-reference information, which shall be included in the set of as-built drawings furnished to the University. The Contractor shall be responsible for and shall pay for the cost of erasable transparencies for its as-built drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Division 01 Section "Construction Facilities and Temporary Controls."

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.

a. Remove labels that are not permanent labels.
b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are vision-detracting materials. Replace chipped or broken glass and other damaged transparent materials.

1) removal of putty stains from glass and mirrors; wash and polish inside and outside;

c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean and dust free. Vacuum carpeted surfaces.

1) removal of spots, paint and soil from resilient, glaze and unglazed masonry and ceramic flooring and wall work;

d. Vacuum as required and advisable and wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps to a mark free condition.
e. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, mud, stones and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

1) restoration of all landscaping, roadway and walkways to pre-existing condition; damage to trees and plantings shall be repaired in the next planting season and such shall be guaranteed for one (1) year from date of repair and/or replanting;

f. removal of marks, undesirable stains, fingerprints, other soil, dust or dirt from painted, decorated or stained woodwork, plaster or plasterboard, metal acoustic tile and equipment surfaces;
g. removal of temporary floor protections; clean, wash or otherwise treat and/or polish all finished floors as directed;
h. clean exterior and interior metal surfaces, including doors and window frames and hardware, of oil stains, dust, dirt, paint and the like; polish where applicable and leave without fingerprints or blemishes;

i. removal of all pollutants of any kind or nature deposited or remaining upon the site or upon the University's property as a result of the construction work on this project;

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.

D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION 017700

SECTION 017820 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the operation and maintenance data as specified herein.

B. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of products, materials, and finishes systems and equipment.

C. Related Sections include the following:

1. Division 01 Section "Summary” for coordinating operation and maintenance manuals covering the Work of multiple contracts.
2. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
3. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
4. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
5. Divisions 02 through 48 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Initial Submittal: Submit two (2) draft copies of each manual at least fifteen (15) calendar days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Owner will return one copy of draft and mark whether general scope and content of manual are acceptable.

1. In lieu of hard copies, Contractor may submit digital copies in PDF format.

B. Final Submittal: Submit two copies of each manual in final form at least fifteen (15) calendar days before final inspection. Architect will return copy with comments within 15days after final inspection.

1. Submit four (4) sets prior to final inspection, bound in 8-1/2” X 11” binders with durable plastic covers, acceptable to the Owner.
2. In addition, Contractor shall submit digital copy in PDF format.
3. Submit final volumes revised, to the authorized representative of the Owner as required in these Contract Documents.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross- reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

2. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets. These manuals shall include a complete description of all systems and equipment, diagrams indicating connectors, oiling requirements, types of lubricants to be used and method of operating equipment. Included within the manuals shall be a list of names, addresses and telephone numbers of sub- contractors involved in the installation and firms capable of performing services for each mechanical item.
3. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual. Internally subdivide the binders contents with permanent page dividers, logically organized as described below and with tab

titling clearly printed under reinforced laminated plastic tabs.

a. PART 1: Directory, listing names, addresses, contact persons and telephone numbers of Architects, Engineers, Contractors, Subcontractors and suppliers.

b. PART 2: Maintenance instructions subdivided by MasterSpec Format Sections as listed within these Contract Documents. For each Section identify names, addresses, contact persons and telephone numbers of Subcontractors and suppliers. Identify the following (in addition to the items listed in “G” above):

1) Significant design criteria
2) List of equipment.
3) Parts list for each component.
4) Maintenance instructions for equipment and systems.
5) Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

4. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
5. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
6. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts, Extra Materials and Maintenance Materials

1. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections. If there are no quantities specified then provide a minimum of five percent (5%) of:

    a. all interior finish materials (attic stock).
    b. the number of lamps and ballast needed for every light fixture.
    c. the total number of automatic light sensors
    d. the total number of each filter type required for each Mechanical Unit requiring filters.

2. Provide 100% of all spare parts necessary to operate and maintain all equipment and building systems within the design parameters and/or as recommended by the manufacturer or supplier.
3. Deliver to Owner’s Project Manager and obtain receipt prior to final payment.
4. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Special Tools

1. Provide any “special tools” (one of each type) if required as part of the operation and maintenance of any of the systems herein specified. “Special tools” are devices that are considered unique to a specified system and necessary for maintenance and operation of that system, and not normally part of the maintenance department inventory.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."

G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017820

SECTION 017829 FINAL SITE SURVEY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This section includes materials and appurtenant work necessary to complete as-built survey and drafting for the site as indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Contractor shall provide and use all necessary equipment and materials to perform the work described herein.

PART 3 - EXECUTION

3.1 AS-BUILT DRAWINGS

A. The Contractor shall be responsible for producing As-Built Drawings of the finished site.

B. The Contractor shall be responsible for the as-built survey of the underground stormwater management basins in accordance with the latest PWD as-built survey guidelines. Contractor is responsible for completing the Construction Certification Package for all on-site stormwater management, conveyance piping, structures, and any other feature associated with the stormwater management.

C. Contractor As-Built Drawings shall reflect the final constructed condition of the extents of Work.

D. As the work progresses, each Contractor shall keep a complete and accurate record of all changes or deviations from the Contract Documents and the Shop Drawings, indicating the work as actually installed. The Contractor is cautioned to note that required survey elevations may need to be taken at various times during construction operations.

E. Within 15 calendar days from substantial completion of the work performed of any Contract, that Contractor shall deliver to the Owner for approval one hard copy and one electronic copy of the survey documents. Features not accurately represented on the As-Built Drawings will not be considered substantially complete as the As-Built information is considered integral to the work performed.

F. After making any corrections required by the Owner, the Contractor shall submit two complete final sets of Record Drawings (hard copy and electronic copy) as described above.

G. Final payment will not be made on any Contract until the required record sets have been reviewed and approved by the Owner.

H. No review or receipt of such documents by the Owner shall be a waiver of any deviation from the Contract Documents or the Shop Drawings, or in any way relieve any Contractor from the responsibility to perform the work in accordance with the Contract Documents and the approved shop drawings.

I. The following shall be documented by a registered professional:
   1. The level bottom elevation, surface area, and total surface area.
   2. The overflow elevation and underdrain invert elevation.
   3. Depth of choker course and aggregate storage layer,

END OF SECTION 017829

SECTION 018200 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training videotapes.

B. Related Sections include the following, as applicable to this project:

1. Division 01 Section "Allowances" for administrative and procedural requirements for demonstration and training allowances.
2. Division 01 Section "Project Management and Coordination" for requirements for pre-instruction conferences.
3. Divisions 02 through 48 Sections for specific requirements for demonstration and training for products in those Sections.

C. Allowances: Furnish demonstration and training instruction time under the Demonstration and Training Allowance as specified in Division 01 Section "Allowances."

D. Unit Price for Instruction Time: Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up.

1.3 SUBMITTALS

A. Instruction Program: Submit one (1) copy of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit one (1) complete training manual(s) for Owner's use.

B. Qualification Data: For instructors.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

E. Demonstration and Training Video: Submit one (1) copy within seven (7) days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date videotape was recorded.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Control Requirements," experienced in operation and maintenance procedures and training.

C. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

D. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Motorized doors, including overhead coiling doors, overhead coiling grilles, and automatic entrance doors.
2. Equipment, including stage equipment, projection screens, loading dock equipment, waste compactors, food-service equipment, residential appliances and laboratory fume hoods, etc.
3. Fire-protection systems, including fire alarm, fire pumps and fire-extinguishing systems.
4. Intrusion detection systems.
5. Conveying systems, including elevators, wheelchair lifts, escalators and cranes.
6. Medical equipment, including medical gas equipment and piping.
7. Laboratory equipment, including laboratory air and vacuum equipment and piping.
8. Heat generation, including boilers, feed water equipment, pumps, steam distribution piping, and water distribution piping.
9. Refrigeration systems, including chillers, cooling towers, condensers, pumps and distribution piping.
10. HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices.
11. HVAC instrumentation and controls.
12. Electrical service and distribution, including transformers, switchboards, panel boards, uninterruptible power supplies and motor controls.
13. Packaged engine generators, including transfer switches.
14. Lighting equipment and controls.
15. Communication systems, including intercommunication, surveillance, clocks and programming, voice and data and television equipment.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project Record Documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.
    l. Required sequences for electric or electronic systems.
    m. Special operating instructions and procedures.

5. Adjustments: Include the following:

    a. Alignments.
    b. Checking adjustments.
    c. Noise and vibration adjustments.
    d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

    a. Diagnostic instructions.
    b. Test and inspection procedures.

7. Maintenance: Include the following:

    a. Inspection procedures.
    b. Types of cleaning agents to be used and methods of cleaning.
    c. List of cleaning agents and methods of cleaning detrimental to product.
    d. Procedures for routine cleaning
    e. Procedures for preventive maintenance.
    f. Procedures for routine maintenance.
    g. Instruction on use of special tools.

8. Repairs: Include the following:

    a. Diagnosis instructions.
    b. Repair instructions.
    c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    d. Instructions for identifying parts and components.
    e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven (7) calendar days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral and a demonstration performance-based test.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEOTAPES

A. General: Engage a qualified commercial photographer to record demonstration and training video. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Recorded Format: MPG file to be provided to the Owner's Project Manager.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Narration: Describe scenes on recording by dubbing audio narration off-site after videotape is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

E. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

END OF SECTION 018200

SECTION 019100 – COMMISSIONING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Commissioning Definition: Commissioning is a systematic process of ensuring and documenting that all building systems perform interactively according to the design intent and the owner's operational expectations and needs. The commissioning process includes documentation, equipment startup, control system calibration, testing, balancing, performance testing, and training where applicable.

B. Commissioning is intended to achieve the following specific objectives according to the Contract Documents:
   1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
   2. Verify and document proper performance of equipment and systems.
   3. Verify that complete O&M documentation is turned over to Rowan Facilities project teams in a formal process.
   4. Verify that the Rowan Facilities project teams are adequately trained.

C. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

1.2 DEFINTIONS

A. A/E- Architect and Engineering Team

B. CxA- Commissioning Authority

C. ATC- Controls Contractor

D. FPC- Fire Protection Contractor

E. FPT- Functional Performance Test

F. GC- General Contractor

G. MEP – Mechanical, Electrical, and Plumbing

H. O&M- Operation and Maintenance

I. PFC- Pre-functional Checklist

J. PM – Rowan University Project Manager

K. TAB- Test and Balance

1.3 COORDINATION

A. Commissioning Team: The members of the commissioning team consist of the Commissioning Authority (CxA), the owner's designated Project Manager (PM), the General Contractor (GC or Contractor), the architect and design engineers (A/E), the MEP subcontractors, the TAB representative, the Controls Contractor (ATC), any other installing subcontractors or suppliers of equipment.

B. Management: The CxA is hired by the Owner directly. The CxA directs and coordinates the commissioning activities. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. The CxA's responsibilities are the same regardless of who hired the CxA.

C. Scheduling: The CxA will work with the GC according to established protocols to schedule the commissioning activities. The CxA will provide sufficient notice to the PM and GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling on an ongoing basis and make necessary notifications in a timely manner in order to expedite the commissioning process.

1.4 COMMISSIONING PROCESS

A. Commissioning Process: The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
   1. Commissioning during construction begins with a scoping meeting conducted by the CxA where the commissioning process is reviewed with the commissioning team members. The CxA shall submit a detailed commissioning pre-functional and functional script/scope and checklists to the project team prior to the start of pre-functional testing.
   2. Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
   3. Equipment documentation is submitted to the CxA during normal submittals, including detailed start-up procedures.
   4. The CxA works with the Subs to develop startup plans and startup documentation formats, which may include providing the Subs with pre-functional checklists to be completed during the startup process.
   5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with pre-functional checklists being completed before functional testing.
   6. The Subs, under their own direction, execute and document the pre-functional checklists and perform startup and initial checkout. The CxA documents that the checklists and startup were completed according to approved plans, and may witness startup of selected systems and equipment.
   7. The CxA develops specific equipment and system functional testing procedures. The Subs review the procedures.
   8. The procedures are executed and documented by the CxA, with the assistance of the Subs as necessary.
   9. Items of non-compliance in material, installation, programming, calibration, start-up or setup are corrected at the Sub's expense and the system retested.
   10. The CxA reviews O&M's for all commissioned systems for completeness.

11. The CxA reviews and approves training plans/agenda for training provided by the Subs (for commissioned equipment), and verifies that training was completed as per the contract documents.
12. The CxA issues report of commissioning process and results.
13. The CxA performs a Near-Warranty End or Post Occupancy Review approximately 6 and 11 months into the 12-month warranty period.

1.5 RELATED WORK

A. Specific commissioning requirements are given in the following sections of these specifications. All of the following sections apply to the Work of this section.
1. 21 08 00 – Fire Suppression Systems Commissioning Requirements
2. 22 08 00 – Plumbing System Commissioning Requirements
3. 23 08 00 – HVAC Systems Commissioning Requirements
4. 26 08 00 - Electrical Systems Commissioning Requirements
5. 27 08 00 - Communication System Commissioning Requirements

1.6 RESPONSIBILITIES

A. The responsibilities of various parties in the commissioning process are provided in this section. It is noted that the services for the Commissioning Authority, Project Manager, Construction Manager, Architect, and HVAC mechanical and electrical designers/engineers are not provided for in this contract. That is, the Contractor is not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process.

B. All Parties
1. Follow the Commissioning Plan and Cx Specification requirements.
2. Attend commissioning meetings, as necessary.

C. Architect
1. Attend the commissioning scoping meeting and selected commissioning team meetings.
2. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
3. Provide any design narrative documentation requested by the CxA.
4. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
5. Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
6. Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.

D. Mechanical, Plumbing and Electrical Designers/Engineers
1. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted.
2. Update final basis of design documentation for inclusion in the Systems Manual.
3. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

4. Attend commissioning scoping meetings and other selected commissioning team meetings.
5. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
6. Provide one-line system diagrams to the CxA for use in preparing the Systems Manual.
7. Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
8. Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

E. Commissioning Authority (CxA)
1. The CxA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CxA may assist with problem-solving, non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E. The primary role of the CxA is to develop and coordinate the execution of a testing plan, observe and document performance — that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the CxA.
2. Where applicable, the CxA will provide information to the US Green Building Council web site in support of satisfying the LEED Energy and Atmosphere (EA) prerequisite 1, Fundamental Commissioning of Building Energy Systems; and EA credit 3, Enhanced Commissioning. The CxA is not the LEED Coordinator for the project.
3. Coordinate the commissioning work and, with the GC and PM, ensure that commissioning activities are being scheduled into the master schedule.
4. Plan and conduct a commissioning scoping meeting and other commissioning meetings.
5. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
6. Before startup, gather and review the current control sequences of operations and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
7. Review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
8. Write and distribute pre-functional and functional tests and checklists.
9. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
10. Approve systems startup by reviewing start-up reports and by selected site observation.

11. Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.
12. With necessary assistance and review from installing contractors, write the functional testing procedures for equipment and systems. This may include energy management control system trending, stand-alone data logger monitoring or manual functional testing. Submit to PM for review, and for approval if required.
13. Analyze any functional performance trend logs and monitoring data to verify performance.
14. Coordinate, witness and approve manual functional tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
15. Perform or witness functional test procedures on the commissioned equipment.
16. Maintain a master deficiency and resolution log and a separate testing record. Provide the PM with written progress reports and test results with recommended actions.
17. Monitor and approve the training plans for the Owner's operating personnel on commissioned systems.
18. Review and approve the preparation of the O&M manuals for commissioned systems.
19. Provide a Systems Manual for all commissioned systems.
20. Provide a final commissioning report (as described in this section).
21. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
22. Return to the site at 6 and 11 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building and equipment as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in resolving outstanding problems.

F. Owner's Project Manager (PM)
1. Manage the contract of the A/E and of the GC.
2. Provide final approval for the completion of the commissioning work.
3. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.

G. General Contractor (GC)
1. Facilitate the coordination of the commissioning work by the CxA, and with the CxA ensure that commissioning activities are being scheduled into the master schedule.
2. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CxA.
3. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
4. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
5. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CxA to facilitate the Cx process.

6. Coordinate the training of owner personnel.
7. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
8. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

H. Equipment Suppliers
1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment testing per agreements with Subs.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CxA.
4. Through the contractors they supply products to, analyze specified products and verify that the designer has specified the newest most updated equipment reasonable for this project's scope and budget.
5. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
6. Review test procedures for equipment installed by factory representatives.

1.7 SYSTEMS TO BE COMMISSIONED

A. The following equipment and associated systems will be commissioned in this project:
1. Division 21: Fire Protection Systems
   a. Fire pump / Jockey pump
2. Division 22: Plumbing Systems
   a. Domestic Cold water
   b. Domestic Hot water
      1) Water Heaters
      2) Recirculation system
   c. Sump pump
3. Division 23: HVAC Systems
   a. Primary Systems
      1) Air terminal units
      2) Fan coil units
      3) Unit heaters
      4) Air-handling units
      5) Rooftop Units and Dedicated Outdoor Air Systems
      6) Exhaust system
      7) Fire and smoke dampers
      8) Ductwork and distribution
      9) Variable Refrigerant Flow (VRF) System
   b. Controls Systems
      1) Workstations
      2) System graphics and dashboards
      3) Networks
      4) Controllers
      5) Sensors
      6) Actuators

4. Division 26: Electrical Systems
    a. Engine Generators & controls
    b. Automatic transfer switches & controls
    c. Interior lighting controls, daylighting and occupancy sensors
    d. Exterior lighting controls
    e. Egress Lighting levels (interior emergency)
5. Division 28: Electronic Safety and Security Systems
    a. Fire alarm system
    b. Interface with fire protection system
    c. Interface with HVAC system

B. General references to equipment will refer to the above systems and their components.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by the TAB contractor in their commissioning responsibilities.

B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site, except for stand-alone data-logging equipment that may be used by the CxA.

C. Data-logging equipment and software required to test equipment will be provided by the CxA for use by the CxA only, and shall not become the property of the Owner.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of ±0.5F and a resolution of ± 0.2F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 MEETINGS

A. Scoping Meeting: The CxA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Information gathered from this meeting will be used by the CxA to revise the Draft Commissioning Plan to its "final" version.

B. Miscellaneous Meetings: CxA may attend regular construction meetings to keep informed of project progress & coordinate the commissioning activities. Other meetings will be planned and

conducted by the CxA as construction progresses.

These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CxA will plan these meetings and will minimize unnecessary time being spent by Subs.

3.2 REPORTING

A. The CxA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, emails, and progress reports, etc.

B. A final summary report by the CxA will be provided to the PM, focusing on evaluating commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report.

3.3 SUBMITTALS

A. The CxA will provide appropriate contractors with a specific request for the type of submittal documentation the CxA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the project team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority. All documentation requested by the CxA will be included by the Subs in their O&M manual contributions.

B. The CxA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

C. The Commissioning Authority will review submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications, which is the A/E's responsibility. The Commissioning Authority will notify the GC, PM or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which requires resubmission.

D. These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CxA will review and approve them.

3.4 START-UP, PREFUNCTIONAL CHECKLIST AND INITIAL CHECKOUT

A. The following procedures apply to all equipment to be commissioned, according to Section 1.06, Systems to be Commissioned.

B. Pre-functional checklists are necessary to ensure that the equipment and systems are operational. It ensures that functional testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment must receive a full pre-functional checkout. No sampling strategies are used. The pre-functional testing for a given system must be successfully completed prior to formal functional testing of equipment or subsystems of the given system. The Commissioning Authority will submit an example of an acceptable and approved format for the PFC. Other formats may be used with the permission of the PM.

C. Start-up and Initial Checkout Plan: The CxA shall assist the contractor in developing pre-functional checklists and a detailed start-up plan for all commissioned equipment. The primary role of the CxA in this process is ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed.
   1. The subcontractor responsible for the purchase of the equipment develops the full start-up plan. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
   2. The full start-up plan could consist of something as simple as:
      a. The CxA's, contractor's or manufacturer's pre-functional checklists.
      b. The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
      c. The manufacturer's normally used field checkout sheets.
   3. The subcontractor submits the full startup plan to the CxA for review and approval.
   4. The CxA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.
   5. The full start-up procedures and the approval form may be provided to the PM for review and approval, depending on management protocol.

D. Execution of Pre-functional Checklists and Startup.
   1. Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the PM, GC and CxA. The performance of the pre-functional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off pre-functional checklists, signatures may be required of other Subs for verification of completion of their work.
   2. The CxA shall verify compliance on at least 20% of equipment requiring formal start-up procedures.
   3. The Subs and vendors shall execute startup and provide the CxA with a signed and dated copy of the completed start-up and pre-functional tests and checklists.
   4. Only individuals that have direct knowledge and witnessed that a line item task on the pre-functional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

E. Deficiencies, Non-Conformance and Approval in Checklists and Startup.
   1. The Subs shall clearly list any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CxA within two days of test completion.

2. The CxA reviews the report and submits either a non-compliance report or an approval form to the Sub or PM. The CxA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CxA will involve the PM, GC and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CxA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CxA recommends approval of the execution of the checklists and startup of each system to the PM using a standard form.
3. Items left incomplete, which later cause deficiencies or delays during functional testing may result in back-charges to the responsible party. Refer to Part 3.06 herein for details.

3.5 FUNCTIONAL TESTING

A. This sub-section applies to all commissioning functional testing for all divisions.

B. Objectives and Scope: The objective of functional testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required.

C. Development of Test Procedures: Before test procedures are written, the CxA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences of operations and parameters. The CxA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor shall provide limited assistance to the CxA in developing the procedures (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CxA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection. The CxA may submit the tests to the A/E for review, if requested.

Functional tests may also be written and performed by the contractor and witnessed by the CxA. Fire protection and emergency generator sequences would be an example of this. In these cases, a test plan would be submitted by the contractor and approved by the CxA prior to testing.

D. Test Methods
1. Functional testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using onboard and BAS/BMS control system's trend log capabilities or by stand-alone data-loggers.

2. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
3. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair dryer rather than overwriting the value or by altering the appropriate set point to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
4. Altering Set Points: Rather than overwriting sensor values, and when simulating conditions is difficult, altering set points to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55F, when the outside air temperature is above 55F, temporarily change the lockout set point to be 2F above the current outside air temperature.
5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during pre-functional testing.
6. Setup: Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. At completion of the test, the CxA shall return all affected building equipment and systems, due to temporary modifications, to their pre-test condition.
7. Sampling
    a. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy.
    Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.
    b. A common sampling strategy is the “xx% Sampling—yy% Failure Rule”, defined by the following example.
        1) xx = the percent of the group of identical equipment to be included in each sample.
        2) yy = the percent of the sample that if failing, will require another sample to be tested.
        3) The example below describes a 20% Sampling—10% Failure Rule.
            a) Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.”
            b) If 10% (yy) of the units in the first sample fail the functional tests, test another 20% of the group (the second sample).
            c) If 10% of the units in the second sample fail, test all remaining units in the whole group.

d) If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

e) Sampling is not to be performed for HVAC equipment. All HVAC equipment shall be tested and commissioned.

E. Coordination and Scheduling.

1. The Subs shall provide sufficient notice to the CxA regarding their completion schedule for the pre-functional checklists and startup of all equipment and systems. The Controls Contractor will provide written notification that they have completed all required pre-functional checklists, wire terminations, point-to-point verification, sensor calibration verification, sequence/programming verification checks, all graphics, trend logs active and that their system(s) are complete and ready for functional testing before testing will proceed. The CxA will schedule functional tests through the PM, GC and affected Subs. The CxA shall develop, execute and document the functional testing of all equipment and systems.
2. In general, functional testing is conducted after pre-functional testing and startup has been satisfactorily completed. The control system is complete and pre-functionally tested before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems.
   When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

F. Test Equipment: Refer to Section 01 9113, Part 2 for test equipment requirements.

G. Problem Solving: The CxA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the GC, Subs and A/E.

3.6 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation: The CxA shall document the results of all functional tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the PM for review and approval and to the Subs for review.

B. Non-Conformance

1. The CxA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the PM on the CxA's standard issues tracking form.
2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work, loosening acceptance criteria, or combining CxA functional testing with the contractor QA checkout procedures to satisfy scheduling or cost.

4. A complete round of tests will be performed, with results and deficiencies reported to the Subs and the PM. The responsible Subs will then have an opportunity to correct the deficiencies and schedule re-testing. Re-testing of up to 10% of the total number of executed tests will be provided by the CxA at no additional charge. Costs of additional re-testing will be as described in the next section.
   a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
      1) The CxA documents the deficiency and the Sub's response with intentions and they go on to another test or sequence. The Sub corrects the deficiency and notifies the CxA that the system is ready to be retested.
      2) The CxA reschedules the test and the test is repeated.
   b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
      1) The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the PM and to the Sub representative assumed to be responsible.
      2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Project Manager.
      3) The CxA documents the resolution process.
      4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CxA.
      The CxA reschedules the test and the test is repeated until satisfactory performance is achieved.
5. Cost of Retesting
   a. The cost to retest a pre-functional or functional test beyond 10% of the total number of tests will be back-charged to the responsible Sub.
   b. For a deficiency identified, not related to any pre-functional checklist or start-up fault, the following shall apply: The CxA and PM will direct the retesting of the equipment once at no "charge" to the GC for their time. However, the CxA's time for a second test will be charged to the GC, who may choose to recover costs from the responsible Sub.
   c. The time for the CxA to execute any re-testing required because a specific pre-functional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back-charged to the GC, who may choose to recover costs from the party responsible for executing the faulty pre-functional test.
   d. Refer to the sampling section of Section 01 9113, Part 3.05 for requirements for testing and retesting identical equipment.
6. The Contractor shall respond in writing to the CxA and PM the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
7. Any required re-testing shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

C. Approval: The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CxA and by the CM, if necessary. The CxA recommends acceptance of each test to the CM using a standard form.

3.7 REPORTS

A. Operation and Maintenance Manuals
1. The specific content and format requirements for the standard O&M manuals are detailed in the Closeout Procedures with specific section requirements in each discipline's divisions.
2. CxA Review and Approval: Prior to substantial completion, the CxA shall review the O&M manuals, documentation and redline as-builds for systems that were commissioned to verify compliance with the specifications. The CxA will communicate deficiencies in the manuals to the PM or A/E, as requested. Upon a successful review of the corrections, the CxA recommends approval and acceptance of these sections of the O&M manuals to the PM. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

B. Final Commissioning Report
1. The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas:
   a. Equipment meeting the equipment specifications
   b. Equipment installation
   c. Functional performance and efficiency
   d. Equipment documentation and design intent
   e. Operator training.
2. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented.
3. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

C. Systems Manual
1. The CxA will provide a Systems Manual in addition to the O&M Manuals submitted by the Contractor. The Systems Manual generally focuses on operating, rather than maintaining the equipment, particularly the interactions between equipment.

The Systems Manual shall include the following for each commissioned system:

a. Final version of the Basis of Design

2. Line diagrams
   a. As-built sequences of operations, control drawings and original setpoints
   b. Operating instructions for integrated building systems
   c. Recommended schedule of maintenance requirements and frequency, if not already included in the project O&M manuals
   d. Recommended schedule for calibrating sensors and actuators

3.8 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

B. The CxA shall be responsible for monitoring and approving the content and adequacy of the training of Owner personnel for commissioned equipment, as called for in the contract documents.
   1. The contractor will provide training for commissioned systems and equipment that covers the following topics but not limited to:
      a. General purpose of the system (design intent)
      b. Use of the O&M manuals
      c. Review of control drawings and schematics
      d. Startup, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.
      e. Interactions with other systems
      f. Adjustments and optimizing methods for energy conservation
      g. Relevant health and safety issues
      h. Special maintenance and replacement sources
      i. Tenant interaction issues
      j. Discussion of environmentally responsive features of the system
   2. In addition to these general requirements, specific training requirements (duration, topics, etc…) of Owner personnel by Subs and vendors is specified in various equipment sections in discipline's Division specifications and in the Demonstration and Training specification.
   3. Each Sub and vendor responsible for training will submit a written training plan to the CxA for review and approval prior to training. At a minimum, the plan will cover the following elements:
      a. Equipment (included in training)
      b. Intended audience
      c. Location of training
      d. Objectives
      e. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
      f. Subjects covered (description, duration of discussion, special methods, etc.)
      g. Duration of training on each subject
      h. Instructor for each subject

3.9 DEFFERRED TESTING

A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition, or other deficiency, execution of checklists and functional testing may be delayed upon approval of the PM. These tests will be conducted as soon as possible. Services of necessary parties will be negotiated.

3.10 WRITTEN WORK PRODUCT

A. The commissioning process generates a number of written work products described in various parts of the specifications. The Commissioning Plan lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them.

B. In summary, the written products are:

Product	**Developed by**
Equipment documentation submittals	Subs
Sequence clarifications	Subs and A/E as needed
Pre-functional checklists	CxA
Start-up and initial checkout plan	Subs w/ assistance from CxA
Pre-functional checklists filled out	Subs
Start-up and initial checkout forms filled out	Subs
Final TAB report	TAB
Issues log (deficiencies)	CxA
Functional test forms	CxA and Subs
Filled out functional tests	CxA and Subs
Training plans and records	Subs
O&M manuals	Subs
Final Commissioning Report	CxA

C. END OF SECTION

SECTION 019500 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.2 SUMMARY

A. Furnish labor, materials, equipment, services, and related item necessary to complete required demolition indicated on the Drawings and described in this Section.

1.3 SUBMITTALS

A. Submit detailed written sequence of demolition and removal work, including time allowed for anticipated utility service shutdowns.

1.02 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of work of this Section.

1.03 PRODUCT HANDLING

A. Protect finished surfaces, including jambs and soffits of openings used as passageways, through which materials are handled.
B. Provide protection for finished floor surfaces in traffic areas prior to allowing materials to be moved over such surfaces.
   1. Maintain full protection during movement of materials.

C. Maintain other finished surfaces clean, unmarred, and suitably protected until final acceptance by Owner.
D. Items directed on the Drawings or in this Section to be reused or relocated shall be handled with appropriate care to maintain their usable condition.
   1. Maintain safe and secure storage of items scheduled for reuse or relocation.
   2. Items scheduled for reuse or relocation damaged during handling shall be repaired or provided new.
   3. Prior to removing items in good condition not scheduled for reuse or relocation, verify Owner's intent to retain the items as Owner's property.
   4. Deliver items requested to be retained by the Owner to Owner's designated place on the premises for storage.
   5. Items not scheduled for reuse, relocation, or to be retained by the Owner, become property of the Contractor and are to be removed promptly from the site.
E. On-site storage or sale of removed items is not permitted.

F. On-site burning of removed items is not permitted.
G. Waste materials, dust, and debris shall be removed from the work site after each work shift, or

more frequently, to maintain safe operations.

1.04 FIRE PROTECTION

A. Pertinent articles of NFPA 241, "Safeguarding Building Construction and Demolition Operations," latest edition, shall apply to work of this Section.
B. When a fire or smoke alarm and detection system is disrupted during demolition and construction, a temporary system approved by the Owner shall be implemented by installation of temporary pull stations and alternate devices such as heat and smoke detection heads or battery operated systems.
1. Obtain Owner's approval for system types and specific locations of components prior to moving, placing, or mounting temporary fire protection equipment.

PART 2 - PRODUCTS

2.01 NO PRODUCTS ARE REQUIRED IN THIS SECTION.

3.00 EXECUTION

3.01 SITE CONDITIONS
A. Prior to work of this Section, examine existing conditions under which work will be performed, and do not proceed until conditions detrimental to timely and proper completion of work have been corrected.

B. Owner assumes no responsibility for actual conditions of any portion of demolition site.
C. If possible, Owner will maintain site conditions existing at the time of pre-construction site investigations, however, variations within the project site may occur because of removals by Owner prior to demolition work.

D. Demolition may not commence until areas to be demolished have been vacated.
E. Where demolition occurs in areas surrounded by occupied spaces, work must be scheduled at Owner's convenience.

3.02 ENVIRONMENTAL CLEARANCES
A. Prior to starting demolition in laboratories, or in any area containing fume hoods, sterilizers, or other equipment which could contain hazardous materials, complete and submit a "Request for Environmental Clearance" form (Owner's Form "A").

B. Prior to starting demolition in a concealed space (vertical or horizontal chase, above monolithic ceiling, cavity wall) where the presence of hazardous materials could be reasonably assumed, complete and submit a "Request for Environmental Clearance" form (Owner's Form "A").

3.03 PUBLIC PROTECTION AND SAFETY

A. Erect temporary partitions, barricades, caution devices, and other protective measures to prevent unauthorized personnel and onlookers from entering demolition areas.

1. Prior to erecting temporary protection, consult with Owner regarding proposed means and methods of protection.
B. Thoroughly seal areas surrounding demolition site from dust and debris resulting from demolition, and comply with governing regulations pertaining to environmental protection.

1. Construct temporary partitions and barriers to be smoke-tight and built of fire-resistant materials.
2. Temporary construction partitions and barriers shall be neat in appearance and effective.
3. Provide walk-off mats at all demolition area entrances and exits.

C. Immediately remove escaped dust and debris from adjacent areas, whether occupied or unoccupied.

D. Do not use water when it may create damage or hazardous conditions such as ice, flooding, and pollution.

E. Conduct demolition procedures and removal of debris to avoid obstructing corridors or required exits or exit accesses.

F. Temporary closing of required exits or exit accesses is to receive written approval in advance of such closing by the local municipal authority having jurisdiction over the Project and local fire department, if required.

G. Provide temporary exit, directional, and fire protection equipment identification signs to replace existing signs that are removed or obstructed.
1. Locate temporary signs to ensure immediate access to safety and to identify locations of fire protection equipment.
2. Temporary signs are to be consistent with building's standard signs if existing signs can not be relocated.

H. If an exterior mobile refuse container is used for collection of debris, its location shall not interfere with normal facility operations or restrict emergency access.
1. Obtain Owner's approval and preference of site location at least 48 hours prior to placement.
2. Schedule removal and replacement so that full contents will not overflow.
3. Excess refuse stored next to containers will not be permitted.

3.04 PREPARATION

A. Carefully study the Contract Documents to determine location and extent of selective demolition to be performed.

B. Prepare and follow an organized plan for demolition and removal of items.

C. Carefully identify limits of selective demolition, marking surfaces to enable workmen to discern between items to remove and items to be left in place.

3.05 PROTECTION OF UTILITIES

A. Maintain in continuous operation existing utility services indicated to remain.

B. Determine accurate locations of utility lines and services by field-verification before commencing with work.
1. Refer to data shown schematically on the Drawings or described elsewhere in the Contract Documents.

C. Take special care to avoid personal injury or property damage which could result from disruption of electrical, communications/data, television, sewer, water, gas, or other utility services when performing work required to remove or re-route utility lines and services.

D. Do not interrupt existing utilities serving occupied or functioning areas unless specifically authorized by the Owner.
1. If required, and if acceptable to the Owner, provide temporary utilities during interruptions in normal service.

E. Prior to work requiring a shutdown of utility services including, but not limited to electrical,

communications/data system, fire alarm and detection, domestic water, sprinkler system, gas, and compressed air, complete and submit a "Request for Utility Shutdown" form (Owner's Form "B").

1. If a utility service shutdown must occur after normal working hours or during the weekend, complete and submit a "Request for Building System Coverage" form (Owner's Form "C") prior to the requested utility service shutdown.

3.06 DEMOLITION

A. Brace as required existing walls, ceilings, and other existing construction to remain; including sawcutting portions of an existing wall.
B. Remove portions of existing construction required by the Drawings, described in this Section, and as might be further found necessary as a result of field conditions to accommodate specified new construction.

C. To maximize salvage potential, carefully cut and remove items in good condition not scheduled for reuse or relocation.
D. Remove all exposed and abandoned piping, ductwork, conduit, cable, and other miscellaneous items connected to mechanical and electrical equipment to be removed.
E. Demolish and remove concrete and masonry in small sections.

F. Remove exterior below-grade items scheduled for demolition to a depth of no less than 18 inches below existing grade level.

G. Remove existing interior items scheduled for demolition to a depth of no less than 1 1/2 inches below existing floor level.
H. Completely remove items scheduled to be demolished and removed leaving surfaces clean, solid, and ready to receive new materials specified in other Sections of these Specifications.

I. Patch and repair areas of removed items flush with adjacent existing surfaces to remain.

END OF SECTION 019500

SECTION 01900.10 – CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section. In the event of any conflicts between the requirements of these Sections, the more stringent requirement shall apply.

1.01 DESCRIPTION

A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.

B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.

C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:

1. Waste Management Plan development and implementation.
2. Techniques to minimize waste generation.
3. Sorting and separating of waste materials.
4. Salvage of existing materials and items for reuse or resale.
5. Recycling of materials that cannot be reused or sold.

D. At a minimum the following waste categories shall be diverted from landfills:

1. Soil.
2. Inerts (eg, concrete, masonry and asphalt).
3. Clean dimensional wood and palette wood.
4. Green waste (biodegradable landscaping materials).
5. Engineered wood products (plywood, particle board and I-joists, etc).
6. Metal products (eg, steel, wire, beverage containers, copper, etc).
7. Cardboard, paper and packaging.
8. Bitumen roofing materials.
9. Plastics (eg, ABS, PVC).
10. Carpet and/or pad.
11. Gypsum board.
12. Insulation.
13. Paint.
14. Fluorescent lamps.

2 REFERENCES

A. New Jersey Department of Environmental Protection (NJDEP)

3 QUALITY ASSURANCE

A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:

1. Excess or unusable construction materials.
2. Packaging used for construction products.
3. Poor planning and/or layout.
4. Construction error.
5. Over ordering.
6. Weather damage.
7. Contamination.
8. Mishandling.
9. Breakage.

B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.

C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.

D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations.

F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.

H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

3.02 TERMINOLOGY

A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.

B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.

C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.

D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.

E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).

F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.

G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.

H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.

I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

    1. On-site Recycling – Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.

    2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.

M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.

N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.

O. Return: To give back reusable items or unused products to vendors for credit.

P. Salvage: To remove waste materials from the site for resale or re-use by a third party.

Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.

R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.

S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

3.03 SUBMITTALS

A. Prepare and submit to the Engineer a written demolition debris management plan. The plan shall include, but not be limited to, the following information:

1. Procedures to be used for debris management.

2. Techniques to be used to minimize waste generation.

3. Analysis of the estimated job site waste to be generated:

   a. List of each material and quantity to be salvaged, reused, recycled.
   b. List of each material and quantity proposed to be taken to a landfill.

4. Detailed description of the Means/Methods to be used for material handling.

   a. On site: Material separation, storage, protection where applicable.
   b. Off site: Transportation means and destination. Include list of materials.
      1) Description of materials to be site-separated and self-hauled to designated facilities.
      2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
   c. The names and locations of mixed debris reuse and recycling facilities or sites.
   d. The names and locations of trash disposal landfill facilities or sites.
   e. Documentation that the facilities or sites are approved to receive the materials.

B. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.

C. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

3.04 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.

B. U.S. Green Building Council (USGBC):

3.05 RECORDS

A. Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

PART 2 - PRODUCTS

2.01 MATERIALS

A. List of each material and quantity to be salvaged, recycled, reused.

B. List of each material and quantity proposed to be taken to a landfill.

C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.01 COLLECTION

A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.

B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.

C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.02 DISPOSAL

A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.

B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.03 REPORT

A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.

B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.

C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

PART 4 – MEASUREMENT AND PAYMENT

4.01 PAYMENT – The cost associated with Construction Waste Management and Disposal shall include all labor, materials and equipment necessary or recommended to complete the work of this section and be included in the Unit Price for Demolition and Relocation

END OF SECTION 019500.10

SECTION 024119

SELECTIVE DEMOLITION AND ALTERATION WORK

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the selective demolition and alteration work as shown on the drawings and/or specified herein, including but not limited to the following:

1. Alterations, selective demolition and removals as noted on drawings and as required to accommodate new construction.

2. Removal of debris.

3. Protection of existing building and spaces to remain, and shoring of the structure as required for structural integrity and personal safety.

4. Protection of existing curbs and sidewalks.

5. Temporary coverage passageways.

6. Alterations, selective demolition and removals of exterior facade where noted.

7. Patching and refinishing of existing surfaces damaged as a result of this work.

8. Protection.

1.3 QUALITY ASSURANCE

A. The Contractor shall comply with the requirements of all applicable Federal, State and local safety and health regulations regarding the demolition of structures including ANSI/NFPD 241-Building Construction and Demolition Operations.

B. The Contractor shall be responsible for any damage to any adjacent structures or buildings to remain.

C. Qualifications: Qualifications of Contractor for work of this Section shall not be less than ten (10) years of field experience in work of this nature.

D. Professional Engineering: The Contractor shall retain the services of a Professional Engineer licensed in the State of New Jersey, who shall design and supervise installation of all underpinning and shoring.

1.4 RELATED SECTIONS

A. Alteration and removal requirements for mechanical and electrical work - Mechanical and Electrical Sections.

1.5 SUBMITTALS

A. Schedule of Demolition Operations: Submit demolition procedures and operational sequence for Architect's review prior to start of work. Submit a written request to Architect well in advance of executing any cutting or alteration which affects:

1. The work of tying in or connecting to operational systems of the building, including electrical, mechanical and security systems.

2. The work of the Owner or any separate Contractor.

3. The structural value or integrity of any element of the project or of adjacent structures.

4. The integrity or effectiveness of weather-exposed and moisture-resistant elements or systems.

5. The efficiency, operational life, maintenance, or safety of operational elements or systems.

B. Notice of Differing Conditions: Submit a written notification if, during the work of demolition and cutting, conditions are discovered which significantly vary from those shown on the drawings. Do not commence work until approval of Architect.

C. Shop Drawings: Submit the following prior to starting work:

1. Submit for Architect's information shop drawings indicating location and typical construction details of temporary dustproof and weatherproof partitions.

2. Submit drawings of temporary structural shoring, bracing, framing or support, for the information of the Architect. Such drawings will be reviewed by the Structural Engineer for the effects of such temporary members on the structural elements to remain. These drawings shall include the reason for such temporary members, the location, the direction and magnitude of design reaction forces on existing structure, and details showing how these reaction forces will be applied to the existing structure.

a. Shop drawings shall be submitted with the Seal of the P.E. engaged by Contractor; P.E. must be licensed in the State of New Jersey.
b. The Architect will receive acknowledgment for concepts shown. Such acknowledgments shall be of the concept only and not of actual capacities or structural design and shall not in any way diminish or limit the Contractor's responsibility for the quality and performance of the work and for protecting existing structures and facilities.

1.6 SPECIAL PRECAUTION

A. Hazardous materials may be encountered during demolition operations including asbestos; comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

1. Lead-Based Paint: Areas of lead-based paint have been identified in the Hazardous

Materials Report. Perform all demolition, disturbance, and handling of lead-containing building materials in full compliance with current codes.

1.7 JOB CONDITIONS

A. Condition of Structure

1. The Contractor for the work of this Section shall be held to have visited the site, examined the premises, determined for himself the existing conditions, character of equipment and facilities needed for the performance of the work, and all matters which may in any way affect the work before submitting a bid.

a. Information regarding existing construction or conditions is based on available record drawings which may or may not truly reflect existing conditions. Such information is included on the assumption that it may be of interest to the Contractor, but the Architect, Owner and their consultants do not assume responsibility for its accuracy or completeness.
b. Notify the Architect if, during the course of demolition, conditions are discovered which significantly vary from those shown on the drawings. Do not proceed until authorized by Architect.

2. The Contractor shall accept the condition of the site and structures as found. The Architect and Owner assume no responsibility for condition of site or structures nor the continuation of the condition existing at time of bidding or thereafter.

B. Areas of building to be demolished or altered will be vacated and discontinued in use prior to the start of the work.

1. Surrounding areas of the building shall remain operational by the Owner.

C. Partial Removal

1. Items of savable value to the Contractor may be removed from the structure as the work progresses. Salvaged items must be transported from the site as they are removed.

2. Storage or sale of removed items on the site will not be permitted.

D. Explosives: The use of explosives will not be permitted.

E. Traffic

1. Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks and other adjacent occupied or used facilities.

2. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

F. Utilities

1. Refer to Division 22 and 26 of the specifications for special requirements concerning utilities and services.

2. Maintain any existing utilities required to remain; keep in service and protect against damage during demolition operations.

3. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to the governing authorities.

4. Disconnect and seal any abandoned utilities before starting demolition operations. Coordinate all work with local utility companies having jurisdiction.

1.8 SCHEDULING

A. Before commencing any alteration or demolition work, submit for review by the Architect, and approval of the Owner, a schedule showing the commencement, the order, and the completion dates for the various parts of this work.

B. Before starting any work relating to existing utilities (electrical, sewer, water, heat, gas, fire lines, etc.) that will temporarily discontinue or disrupt service to the structures to remain, notify the Architect and the Owner 7 days in advance and obtain the Owner's approval in writing before proceeding with this phase of the work.

PART 2 PRODUCTS

Refer to Part 3 - Execution, for Product Requirements

PART 3 EXECUTION

3.1 PROTECTION

A. Take full precautions to protect workmen, passersby or any other persons from falling debris and other hazards of demolition operations.

B. Execute demolition work to ensure protection of existing portions of building to remain against damages which might occur from falling debris or other cause. Do not interfere with use of adjacent occupied buildings and areas. Maintain free, safe passage to and from occupied adjacent buildings.

C. Materials Placement: Do not load structure with weight that will endanger, overload or cause excessive deflection of the existing structure, or that will damage finished surfaces adjacent to and/or supported by the existing structure, except portions being removed.

D. Construction Operations: Do not employ any construction operation, equipment or vehicles that will endanger, overload or cause excessive deflection of the existing structure, or that will damage finished surfaces adjacent to and/or supported by the existing structure, except portions being removed.

E. Take precautions to guard against movement, settlement, damage, or collapse of any part of building, sidewalks, adjacent property or street passages; be liable for any such movement, settlement or collapse. If such damage does accidentally occur, Contractor shall repair promptly at no cost to Owner.

F. Provide the necessary safeguards to prevent accidents, to avoid all necessary hazards and protect the public, the work and property at all times, including Saturdays, Sundays, and holidays.

G. Be responsible for any and all damages which may arise or occur to any party whatsoever by reason of the neglect in providing proper lights, guards, barriers, or any other safeguards to prevent damage to property, life and limb.

H. Make such explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal. Give particular attention to shoring and bracing requirements so as to prevent any damage to existing construction.

1. Provide interior and exterior shoring, bracing, or support to prevent movement or settlement or collapse of structures to be demolished and adjacent facilities to remain. The Contractor's Professional Engineer shall advise on bracing, shoring, underpinning, or other structural requirements. The Contractor shall bear all responsibility for prevention of movement or other structural fault.

2. The Contractor shall restore, by repair or otherwise, the portions of structure or their contents altered by the Contractor in furtherance of his underpinning and support operations. Restoration shall be completed to the conditions which existed prior to the start of the work. Any damage caused by inadequate support shall also be restored by the Contractor at no cost to the Owner.

I. Provide, erect and maintain catch platforms, lights, barriers, weather protection, warning signs, and other items as required for proper protection of the workmen engaged in demolition and alteration operations, occupants of the building, public and adjacent property. Any damage caused by the Contractor's operations shall be promptly repaired by the Contractor at no cost to the Owner.

J. Provide and maintain temporary protection of the existing structure designated to remain where demolition, removal, and new work are being done, connections made, materials handled, or equipment moved.

K. Take necessary precautions to prevent dust and dirt from rising. Protect unaltered portions of the existing building affected by the operations under this Section by dustproof partitions and other adequate means.

L. Provide adequate fire protection in accordance with local Fire Department requirements.

M. Do not close or obstruct walkways, passageways, or stairways. Do not store or place materials in passageways, stairs, or other means of egress. Conduct operations with minimum traffic interference.

N. Be responsible for any damage to the existing structure or contents by reason of the insufficiency of protection provided.

O. Erect temporary covered passageways at street level as required by authorities having jurisdiction.

P. Promptly repair damages caused to adjacent facilities by demolition operations at no cost to the Owner.

Q. Provide and maintain weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.

3.2 INSPECTION

A. Verify that areas of demolition work are protected and temporary dustproof partitions have been installed.

B. Verify that construction to be removed is not load bearing or has been properly braced, framed or supported.

C. Inspect existing conditions of the project, including elements subject to damage or to movement during demolition and cutting.

D. After uncovering work, inspect the conditions affecting the installation or performance of the work.

1. Report differing or questionable conditions to the Architect in writing; do not proceed with the work until the Architect has provided further instructions.

3.3 PREPARATION

A. Provide adequate temporary support as necessary to assure the structural value or integrity of the affected portion of the work

B. Provide devices and methods to protect other portions of the project from damage.

C. Pollution Controls

1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.

a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

2. Clean adjacent structures and improvements of dust, dirt and debris caused by demolition operations. Return adjacent areas to condition existing prior to the start of the work.

3. Provide drainage for temporary water use.

3.4 DEMOLITION AND CUTTING

A. Selectively demolish existing construction in conformance with the drawings and these specifications.

1. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surface to receive installation of work by others and patching of finish surfaces.

2. Do all cutting or removal so as to leave neat, true, plumb and square edges, at edges to remain. Use carborundum or diamond saw equipment for cutting masonry, concrete and stone work, where edges or surfaces are to remain.

3. Do not cut or remove construction which might weaken or impair the structural integrity or strength of the structural framing or support systems which are to remain.

4. Demolish and remove materials as shown on the drawings without damage to the remaining parts of the structure or mechanical/electrical/utility systems.

5. Remove materials so as to not impose excessive loads in supporting walls, floors or framing and so as not to damage remaining undemolished portions of the structure.

6. Where portions of structures are to be removed, remaining portions shall be protected from damage and prepared to fit new construction. Damage to portions of structures to remain shall be repaired.

7. Reinforcing steel in existing structures shall be left in place, cleaned and aligned to provide tie with new work.

8. Existing waterproofing systems and flashings shall be carefully exposed and protected to maintain workable conditions of fitting new work with existing construction.

9. Proceed with demolition in a systematic manner.

10. Demolish concrete and masonry in small sections.

11. Remove structural framing members and lower to ground by means of hoists, derricks, or other suitable methods.

B. Shoring

1. Design, provide, erect and maintain necessary temporary shoring, bracing, framing, or support where load bearing structural or supporting members are removed or weakened by cuts or openings or are subject to damage from demolition operations, and otherwise as required for safety or to protect finish surfaces from damage.

2. Construction and adequacy of the shoring shall be the entire responsibility of the Contractor. Any damage caused by the inadequacy of the shoring or other support shall be the responsibility of the Contractor to remedy at no additional expense to the Owner.

3. Shoring and bracing shall remain until new structural framing and/or supports are installed. Coordinate operations fully with other trades.

4. Be ready at any time to promptly provide, add to, or strengthen temporary shoring, bracing, or support for existing work, in case existing construction begins to show signs of structural stress.

3.5 WORKMANSHIP STANDARDS FOR ALTERATION AND REMOVAL WORK

A. Cut, remove, alter, temporarily remove and replace, or relocate existing work as required for performance of the work. Perform such work required with due care, including shoring and bracing.

B. Coordinate patching involving the various trades whether or not specifically mentioned in the respective specification Sections.

C. Materials or items demolished and not designated to become the property of the Owner or to be reinstalled shall become the property of the Contractor and shall be removed from the Owner's property.

D. Execute the work in a careful and orderly manner, with the least possible disturbance to the public and to the occupants of the adjacent buildings.

E. In general, demolish masonry in small sections. Where necessary to prevent collapse of any construction, install temporary shores, struts, or bracing.

F. Materials to be removed by existing elevators shall be put in enclosed containers.

G. Where existing equipment and/or fixtures are indicated to be reused, repair such equipment and/or fixtures and refinish to put in perfect working order. Refinish as directed.

H. Cut out embedded anchorage and attachment items as required to properly provide for patching and repair of the respective finishes.

I. Confine cutting of existing roof areas designated to remain to the limits required for the proper installation of the new work. Cut and fold back existing roofing. Cut and remove insulation and related items. Provide temporary weathertight protection as required until new roofing and flashings are installed. Consult the Owner to ascertain if existing guarantee bonds are in force and execute the work so as not to invalidate such bonds.

J. Where utilities are removed, relocated or abandoned, cap, valve, plug, or by-pass to make complete and working installation.

K. Restore existing pipe and duct coverings damaged by work under this Contract to original undamaged condition.

L. Immediately restore to service and repair any damage caused by Contractor's workmen to existing pipe and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems which are not scheduled for discontinuance or abandonment.

M. Upon completion of contract, deliver work complete. Damage that may be caused by Contractor or Contractor's workmen to existing structures designated to remain, grounds, and utilities shall be repaired by Contractor and left in as good condition as existed prior to damaging.

N. Restore finish work of floors, walls, and ceilings remaining in place but damaged or defaced because of demolition or alteration work to condition equal that which existed at beginning of work under this Contract.

O. Where alteration or removals expose damaged or unfinished surfaces or materials, refinish such surfaces or materials, or remove them and provide new or salvaged materials to make continuous surfaces uniform.

P. Perform new work and restore and refinish existing work in conformance with applicable requirements of the specifications, except as follows:

1. Materials for use in repair of existing surfaces, but not otherwise specified, shall conform to the highest standards of the trade involved, and be in accordance with approved industry standards, and shall be as required to match existing surfaces.

2. Workmanship for repair of existing materials shall, unless otherwise specified, be equal to similar workmanship existing in or adjacent to the space where the work is being done.

3. Installation of salvaged items where no similar items exist shall be done in accordance with the highest standards of the trade involved and in accordance with

approved shop drawings.

Q. Materials or items designated to become the property of the Owner shall be as shown on the drawings. Remove such items with care and store them in a location at the site to be designated by the Owner.

R. Materials or items designated to be reinstalled shall be as shown on the drawings. Remove such items with care under the supervision of the trade responsible for reinstallation; protect and store until required. Replace materials or items damaged in their removal with similar new material.

S. The existing building shall not be used as a work shop. Neither shall the furnishings or equipment in any room be used as work benches. Should any damage occur during the progress of the work to any furniture, fixtures, equipment, or appurtenances therein, such damage shall be repaired, replaced or made good by the Contractor without extra cost to the Owner.

T. Where removing existing floor finish and base, remove all adhesive and leave floors and walls smooth and flush, ready to receive new finish.

U. Finish new and adjacent existing surfaces as specified for new work. Clean existing surfaces of dirt, grease and loose paint before refinishing.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General

1. Remove from the site debris, rubbish and other materials resulting from work of this Section.

2. Burning of removed materials from demolished structures will not be permitted on the site.

B. Removal: Transport materials removed from demolished structures and legally dispose of off site. Pay any and all fees associated with disposal work. Leave the site in an orderly condition to the approval of the Architect.

3.7 CLEANING UP

A. Remove debris as the work progresses. Maintain existing premises in a neat and clean condition.

END OF SECTION

SECTION 033053 – MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SCOPE OF WORK

A. This Section includes the following applications for site concrete:
1. Fence Foundations – Class A
2. Concrete Steps – Class A
3. Retaining Wall – Class A
4. ADA Curb Ramp – Class

1.1 REFERENCES

A. The most current version of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. NJDOT Specifications for Roadway and Bridge Construction, except that measurement and payment sections do not apply.

C. AMERICAN CONCRETE INSTITUTE (ACI)
1. ACI 301: Specification for Structural Concrete
2. ACI 347: Guide to Formwork for Concrete
3. ACI 304R: Guide for Measuring, Mixing, Transporting and Placing Concrete
4. ACI 309R: Guide for Consolidation of Concrete
5. ACI 306.1: Standard Specification for Cold Weather Concreting
6. ACI 311.4R: Guide for Concrete Inspection
7. ACI 311.5R: Batch Plant Inspection and Field Testing of Ready-Mixed Concrete
8. ACI 350R: Code Requirements for Environmental Engineering Concrete Structures
9. ACI SP 66: ACI Detailing Manual

D. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM A 185: Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
2. ASTM A 615: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
3. ASTM C 31: Standard Practice for Making and Curing Concrete Test Specimens in the Field
4. ASTM C 33: Standard Specification for Concrete Aggregates
5. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
6. ASTM C 42: Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
7. ASTM C 94: Standard Specification for Ready-Mixed Concrete

8. ASTM C 143: Standard Test Method for Slump of Hydraulic Cement Concrete
9. ASTM C 150: Standard Specification for Portland Cement
10. ASTM C 171: Standard Specification for Sheet Materials for Curing Concrete
11. ASTM C 172: Standard Practice for Sampling Freshly Mixed Concrete
12. ASTM C 231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
13. ASTM C 260: Standard Specification for Air-Entraining Admixtures for Concrete
14. ASTM C 309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
15. ASTM C 494: Standard Specification for Chemical Admixtures for Concrete
16. ASTM C 618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
17. ASTM C 1064: Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete
18. ASTM D 1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
19. ASTM D 1752: Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

E. The Contractor is required to always have one copy of the latest edition of each of the following publications available for review in the job-site construction office while performing the work described in this Section. The Contractor is to comply with each of the following unless more stringent requirements are indicated on the Drawings or within these specifications.
1. New Jersey Department of Transportation 2019 Standard Specifications for Road and Bridge Construction, latest edition - except that measurement and payment sections do not apply
2. ACI 301: Specification for Structural Concrete

1.2 SUBMITTALS

A. General: Submit each item in accordance with the General Requirements and Conditions of the Contract documents.

B. Product Data: For each type of manufactured material and product indicated.

C. Design Mixes: For each concrete pavement mix and class. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

D. Joint Layout: Submit a sketch showing the location of all expansion and control joints and scoring prior to placing concrete. Indicate method of installing score lines.

E. Shop Drawings: For concrete reinforcement, including dowels, wire fabric, bar layout, and all other reinforcement. Shop drawings shall be in accordance with the ACI SP66 and detailed at scales to clearly show the layout of all new reinforcing steel.

F. Laboratory test reports: From a testing laboratory meeting the requirements of paragraph 1.05.C below, indicating and interpreting test results for compliance with the requirements indicated within these specifications and based on comprehensive testing of current materials and mix designs.

G. Material Certificates: Signed by manufacturers and the Contractor certifying that each of the following materials complies with or exceeds requirements:

1. Cementitious materials and aggregates.
2. Admixtures.
3. Curing compounds.
4. Applied finish materials.
5. Bonding agent or adhesive.
6. Joint fillers and sealers.
7. Forming accessories.
8. Steel reinforcement.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that required for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.

C. Testing Agency Qualifications: "Testing Agency Qualifications": An independent testing agency conforming to the requirements of the American Concrete Institute Publications ACI 311.4R and ACI 311.5R (latest editions), and acceptable to the project team

D. Source Limitations: Obtain each type of class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

E. ACI Publications: Comply with ACI 301, unless modified by the requirements of the Contract Documents.

F. Concrete Testing Service: Engage a qualified independent testing laboratory to perform material evaluation tests and to design concrete mixes.

1.4 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans.

1.5 REGULATORY REQUIREMENTS

A. Traffic Control: Maintain access of and protection for vehicular and pedestrian traffic as required for construction activities in accordance with local regulations.

B. Contractor shall obtain all necessary Borough of Glassboro, Gloucester County, and State of NJDOT road opening permits and approvals, upon the Contractor receiving Notice to Proceed and prior to proceeding with the Work.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces. Use flexible or curved forms for curves of a radius 100 feet or less.

B. Form Release Agent: Provide commercially formulated form-release agent with a maximum of 350 g/l volatile organic compound (VOCS) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 CONCRETE MATERIALS

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.

B. Portland Cement: ASTM C 150, type IA.

C. Fly Ash: ASTM C 618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.

D. Normal-Weight Aggregates: ASTM C 33, Class 4, uniformly graded, from a single source, with coarse aggregate as follows:
1. Size 67.
2. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
3. Do not use fine or coarse aggregate containing substances that cause spalling.

E. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a No. 4 sieve, 10 percent maximum shall pass a No. 100 sieve.

F. Water: Potable, ASTM C 94.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Joint Dowel Bars: ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

C. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

2.4 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain no more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures. Use only one manufacturer as a source for all admixtures. Contractor is responsible for verifying that any and all admixtures, when used in combination, are compatible with any other admixture used in mix design. Verification to be provided with mix design and product data submittals, for review by the Owner.

B. Air-Entraining Admixtures: ASTM C 260, certified by manufacturer to be compatible with other required admixtures and not containing more chloride ions than are present in municipal drinking water.

C. Water-Reducing Admixture: ASTM C 494, Type A, certified by manufacturer to be compatible with other required admixtures and not containing more chloride ions than are present in municipal drinking water.

D. High-Range Water-Reducing Admixture: ASTM C 494, Type F or G, and not containing more chloride ions than are present in municipal drinking water.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

G. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq.yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film-forming compound, manufactured for application to fresh concrete for temporary protection from rapid moisture loss.

E. Clear or white Liquid-Membrane-Forming Curing Compound: NJDOT.

2.6 CONCRETE PROTECTION MATERIALS

A. Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the Contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except those that emulsify mixtures are not acceptable.

2.7 RELATED MATERIALS

A. Expansion-and-Isolation-Joint-filler-Strips: NJDOT.

B. Joint Sealer: In accordance with NJDOT.

C. Graphite Lubricant: In accordance with NJDOT.

2.8 CONCRETE MIXES

A. Prepare design mixes, proportioned according to NJDOT, for each type and strength of concrete.

B. Use an independent testing agency meeting the requirements of paragraph 1.5.C for preparing and reporting proposed mix designs for the trial batch method.

C. Proportion mixes to provide concrete with the following properties.
   1. Compressive strength: Class C – 2,000 psi (28 day); Class A – 3,300 psi (28 day); Class AA – 3,750 psi (28 day); Class AAA - 4,500 psi (28 day); H.E.S – 3,000 psi (3-day).
      a. Sewer Lateral Connection – Class C
      b. Concrete Pads – Class A
      c. Pipe Bollard Foundations – Class A
      d. Chain Link Fence Foundations – Class A
      e. Concrete Footway – Class A
      f. Concrete Curb – Class A
      g. Concrete Wheel Stop – Class A
   2. Maximum Water-Cementitious Materials Ratio: at point of placement, 0.45.
   3. Slump Limit: 3 inches, in accordance with ASTM C143.
      a. Slump Limit for concrete containing high-range-water admixture (superplasticizer): not more than 8 inches after adding admixture to plant-or-site verified, 2-to-3-inch slump concrete.

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
   1. Fly Ash: 15 percent.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.
   1. When air temperature is between 85 degrees F and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

A. Compact subgrade as indicated in Section 321116. Proceed with pavement only after nonconforming conditions have been corrected and subgrade and base course are stable and ready to receive pavement. Subgrade shall be in a moist condition when concrete is placed.

B. Remove loose material from compacted base course surface immediately before placing concrete.

3.2 FORMWORK, EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure formwork, including edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement. Form work shall be in accordance with ACI 347.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendation in CRSI's "Placing Reinforcing bars" for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, dirt, ice, or other bond reducing materials.

C. Arrange, space, and securely tie bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

3.4 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318 or ACI 350R and as indicated on the Drawings.

B. Inspection: Before placing concrete, inspect and complete formwork installation, and installation of all items to be embedded or cast in. Notify other trades so that they may install any embedded or cast in items required for their work prior to Contractor's inspection.

C. Remove snow, ice, or frost from subbase or base course surface before placing concrete. Do not place concrete on surfaces that are frozen.

D. Moisten base course to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

E. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

F. Do not add water to concrete during delivery, at Project, or during placement.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Immediately lay welded wire fabric or bar mats in final position. Place top layer of concrete, strike off, and screed.
   1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if approved by the Engineer.

J. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open texture and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations.

K. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

L. Cold-Weather Placement: Comply with ACI 306.1 and as follows: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F and not more than 80 degrees F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

M. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as specified when hot weather conditions exist.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 degrees F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog spray forms and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.5 JOINTS

A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated on the Drawings.
1. When joining existing pavement, place transverse joints to align with previously placed joints, unless indicated otherwise on the Drawings.

B. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, manholes, inlets, structures, sidewalks, other fixed objects, and where otherwise indicated on the Drawings.
1. Locate expansion joints at maximum intervals of 150 feet unless shorter intervals are otherwise indicated on the Drawings.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than ½ inch or more than 1 inch below finished surface if joint sealant is indicated to be used above joint filler.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not to be used.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
7. Install joint sealer in accordance with Manufacturer's instructions.

C. Transverse Control Joints: Form weakened-plane transverse control joints, sectioning concrete into areas as indicated on the Drawings. Where sectioning is not indicated on the Drawings, space joints as described within this Section. Construct transverse control joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a 3/8-inch radius unless shown otherwise on the Drawings. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

D. Edging: Tool edges of pavement, curbs, and joints formed in concrete after initial floating with an edging tool to a 3/8-inch radius unless shown otherwise on the drawings. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
   1. Sealant: Provide joint sealant at all isolation joints in accordance with sealant manufacturer's written instructions.

3.6 CONCRETE FINISHING

A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Comply with ACI-302-1R, regarding slab construction, regarding overworking of slab surfaces during finishing operations; in such cases where the air entrainment exceeds 3%.

C. Float Finish: Begin the second floating operation when bleed water sheen has disappeared, and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Re-float surface immediately to a uniform granular texture.

D. Surface Texture: Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris. Any type of transverse texturing shall produce grooves in straight lines across each lane within a tolerance of plus or minus 1/2 inch of a true line.
   1. Produce a surface which is free from porous spots, irregularities, depressions, and small pockets or rough spots which may result from accidentally disturbing particles of coarse aggregate embedded near the surface.
   2. Broom Texturing – Concrete pavement and sidewalks. Surface texture shall be applied using an approved mechanical stiff bristle broom drag of a type that will uniformly score the surface. The broom shall be operated to score the surface transverse to the pavement center line. The broom shall be capable of traversing the full width of the pavement in a single pass at a uniform speed and with a uniform pressure. Successive passes of the broom shall be overlapped the minimum necessary to obtain a uniformly textured surface. Brooms shall be washed thoroughly at frequent intervals during use. Worn or damaged brooms shall be removed from the job site. Brooming should be completed before the concrete has hardened to the point where the surface will be unduly torn or roughened, but after hardening has progressed enough so that the mortar will not flow and reduce the sharpness of the scores. Specific requirements for the texturing will be given on the drawings, but, if not given, the scores shall be uniform in appearance and approximately 1/16 inch in depth but not more than 1/8 inch in depth. Hand brooming will be permitted only on isolated odd-shaped slabs or slabs where hand finishing is permitted. For hand brooming, the brooms shall have handles longer than half the width of slab to be finished.

The hand brooms shall be drawn transversely across the surface from the centerline to each edge with slight overlapping strokes.

3. On inclined slab surfaces including sidewalk curb ramps, provide a coarse, non-slip finish by scoring surface with a stiff bristled broom, perpendicular to line of traffic.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold and hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and follow recommendations in ACI 305R for hot weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy weather conditions cause moisture loss approaching 0.2 lb./sq. ft x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials.
   a. Water.
   b. Continuous water-fog-spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 TOLERANCES

A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 inch and -3/4 inch.

B. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +3/4 inch and - 1/4 inch.

C. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 3, 4, and 5 (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 inch and -1/2 inch where gross bar length is less than 12 feet, or +0 inch and -3/4 inch where gross bar length is 12 feet or more.

D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155 for exterior slabs, except as follows:

1. Test entire slab surface, including those areas within 2 feet of construction joints and vertical elements that project through slab surface.
2. Maximum elevation change that may occur within 2 feet of any column or wall element is 0.25 inches.
3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 5 feet.

3.9 FIELD QUALITY CONTROL TESTING

A. Testing Laboratory: As part of this contract the Contractor shall retain the services of an independent testing and inspection laboratory meeting the qualifications of paragraph 1.5.C to sample materials, perform tests and prepare and submit reports during concrete placement.

B. Testing Services: Testing shall be performed according to the following requirements:
1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.
2. Slump: ASTM C 143: One test at point of placement for each concrete truck delivery. Slump testing is to be performed prior to concrete placement. Addition of water to the concrete mix is not permitted after slump test.
3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
4. Concrete temperature: ASTM C 1064; one test hourly when air temperature is 40 degrees F and below and when 80 degrees F and above, and one test for each set of compressive-strength specimens.
5. Compression Test Specimens: ASTM C 31 one set of four standard cylinders for each compression-strength test, unless directed otherwise. Cylinders shall be molded and stored for laboratory-cured test specimens except when field-cured test specimens are required. Contractor shall provide an insulated storage box for concrete cylinders.
6. Compression-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; and one specimen shall be retained in reserve for later testing if required.
7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
8. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive-strength and no individual compressive-strength test result falls below specified compressive-strength by more than 500 psi.
9. Thickness Evaluation: The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section.

C. Test results shall be reported in writing to the Owner, concrete manufacturer, and Contractor, within 24 hours of testing. Reports of compressive-strength tests shall contain the concrete manufacturer and Contractor name, Project identification name and number, date of concrete placement, name of concrete testing laboratory, concrete type and class, location of concrete batch in pavement, design compressive-strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Owner but shall not be used as the sole basis for approval or rejection.

E. Additional Tests: Testing laboratory shall make additional tests of concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by the Owner. Testing laboratory may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

F. Appearance: Exposed surfaces of the finished work will be inspected by the Owner and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the works shall be removed and replaced at the Contractor's sole expense.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet the requirements in this Section. Concrete sections shall be removed to the nearest regularly spaced joint.

B. Drill test cores, where directed by the Owner, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than 2 days before date scheduled for Substantial Completion inspections.

E. Repair Surface Defects in accordance with ACI 301.

END OF SECTION 033053

SECTION 035416

CEMENT LEVELING COMPOUND

PART 1 GENERAL

1.1 DESCRIPTION

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the cement leveling compound as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Self-leveling cement compound applied over existing concrete substrates, thickness shall be 1/4" minimum.

1.3 RELATED SECTIONS

A. Concrete work - Section 033000.

1.4 QUALITY ASSURANCE

A. Applicator: Company specializing in performing the work of this Section with a minimum of 3 years' experience and approved by the manufacturer of the product used.

1.5 SUBMITTALS

A. Submit catalog information and product data for material to be used.

B. Submit approval letter as required by Article 3.1, para. B. herein.

1.6 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.7 MOCK-UP

A. Construct a mock-up of underlayment material, 8 feet long by 8 feet wide.

B. Locate where directed by the Architect.

C. Approved mock-up may remain as part of the Work.

1.8 JOB REQUIREMENTS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F. 24 hours before, during, and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture and until underlayment is dry, allow a minimum of seven (7) days.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Subject to the requirements specified herein, provide one of the following products or approved equal

1. “Supercap SC500” by Laticrete.
2. “Sikalevel 325” by Sika.
3. "Level Set 200" by ProSpec.
4. "K-15" made by Ardex.
5. "Ultraplan 1 Plus" by the Mapei Corp. (rapid setting).
6. "Novoplan 2 Plus" by the Mapei Corp. (standard setting).
7. "Level Quick R/S" or "E/S" by Custom Building Products.

2.2 MATERIALS

A. Underlayment: One of the above listed products.

B. Water: Potable and not detrimental to underlayment mix materials.

C. Primer: Manufacturer's recommended type.

D. Joint and Crack Filler: Latex based.

2.3 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Mix to achieve following characteristics:

1. Density: 115 lb./cu. ft. minimum dry density.
2. Compressive Strength: 4,000 psi minimum in accordance with ASTM C 109.
3. Fire Hazard Classification: Flame/Smoke rating of 0/0 in accordance with ASTM E 286.

C. Mix to self-leveling consistency.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where cement leveling compounds are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

B. Manufacturer’s representative must inspect surfaces to receive cement leveling compound and approve those surfaces in writing to the Architect prior to start of application.

3.2 PREPARATION

A. Vacuum clean surfaces; remove any material (curing compounds, film, dirt) that would be detrimental to bond of cement leveling compound.

B. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

C. Close floor openings.

3.3 APPLICATION

A. Install underlayment in accordance with manufacturer's instructions.

B. Place to minimum 1/4" thickness.

C. Transition to existing floor; use stiff mix to slope to align with existing adjacent floor.

3.4 CURING

A. Air cure in accordance with manufacturer's instructions.

3.5 APPLICATION TOLERANCE

A. Top Surface: Level to 1/8 inch in 10 ft.

3.6 PROTECTION OF FINISHED WORK

A. Do not permit traffic over unprotected floor underlayment surfaces and until underlayment is completely dry.

END OF SECTION

SECTION 040110 - MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cleaning the following:

1. Unit masonry surfaces.
2. Stone surfaces.

1.2 DEFINITIONS

A. Low-Pressure Spray: **100 to 400 psi (690 to 2750 kPa)**

B. Medium-Pressure Spray: **400 to 800 psi (2750 to 5510 kPa)**

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **Project site**.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 QUALITY ASSURANCE

A. Mockups: Prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Cleaning: Clean an area **approximately 25 sq. ft. (2.3 sq. m)** for each type of masonry and surface condition.

a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
c. Start with cold water and low pressure, use a soft bristle brush for stubborn spots before increasing temperature and pressure.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Water: Potable.

B. Warm Water: Water heated to a temperature of 90 to 140 deg F (60 to 71 deg C).

C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.

D. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 5 quarts (5 L) of 5 percent sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every 5 gal. (20 L) of solution required.

PART 3 -

PART 4 - EXECUTION

4.1 CLEANING MASONRY, GENERAL

A. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from **20 feet** away by Architect.

B. Proceed with cleaning in an orderly manner; work from **top to bottom** of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.

C. Use only those cleaning methods indicated for each masonry material and location.

1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage surfaces, including joints.

    a. Equip units with pressure gages.
    b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
    c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
    d. For heated water-spray application, use equipment capable of maintaining temperature between 90 and 140 deg F (60 and 71 deg C) at flow rates indicated.

D. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces. Keep wall wet below area being cleaned to prevent streaking from runoff.

E. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to the "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.

F. Water-Spray Application Method: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from masonry surface and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.

4.2 PRELIMINARY CLEANING

A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open joints to whatever depth they occur.

B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances include paint, calking, asphalt, and tar.

1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.

4.3 CLEANING MASONRY

A. Detergent Cleaning:

1. Wet surface with **cold** water applied by low-pressure spray.
2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
3. Rinse with **cold** water applied by **low**-pressure spray to remove detergent solution and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

B. Mold, Mildew, and Algae Removal:

1. Wet surface with **cold** water applied by low-pressure spray.
2. Apply mold, mildew, and algae remover by brush **or low-pressure spray**.
3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and

crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.

4. Rinse with **cold** water applied by **low**-pressure spray to remove mold, mildew, and algae remover and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

END OF SECTION 040110

SECTION 040120 - MASONRY RESTORATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the masonry restoration and cleaning as shown on the drawings and/or specified herein, including but not limited to, the following:

1. Re-pointing existing face brick walls.

1.3 QUALITY ASSURANCE

A. Field-Constructed Mock-Ups: Prior to start of general masonry restoration, prepare the following sample panels on the building where directed by Architect. Obtain Architect's acceptance of visual qualities before proceeding with the work. Retain acceptable panels in undisturbed condition, suitably marked, during construction as a standard for judging completed work.

1. Repointing: Prepare two (2) separate sample areas of approximately 2' high by 2' wide for each type of repointing required, one for demonstrating methods and quality of workmanship expected in removal of mortar from joints and the other for demonstrating quality of materials and workmanship expected in pointing mortar joints.

1.4 SUBMITTALS

A. Product Data: Submit manufacturers' technical data for each product indicated including recommendations for their application and use and VOC compliance. Include test reports and certifications substantiating that products comply with requirements.

B. Restoration Program: Submit written program for each phase of restoration process including protection of surrounding materials on building and site during operations. Describe in detail materials, methods and equipment to be used for each phase of restoration work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Carefully pack, handle, and ship masonry units and accessories strapped together in suitable packs or pallets or in heavy cartons. Unload and handle to prevent chipping and breakage.

B. Deliver other materials to site in manufacturer's original and unopened containers and

packaging, bearing labels as to type and names of products and manufacturers.

C. Protect masonry restoration materials during storage and construction from wetting by rain, snow or ground water, and from staining or intermixture with earth or other types of materials.

D. Protect grout, mortar and other materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

1.6 PROJECT CONDITIONS

A. Do not repoint mortar joints or repair masonry unless air temperatures are between 40 deg. F. and 80 deg. F. and will remain so for at least forty-eight (48) hours after completion of work.

B. Prevent grout or mortar used in repointing and repair work from staining face of surrounding masonry and other surfaces. Remove immediately grout and mortar in contact with exposed masonry and other surfaces.

C. Protect sills, ledges and projections from mortar droppings.

1.7 SEQUENCING/SCHEDULING

A. Perform masonry restoration work in the following sequence:

1. Repair existing masonry including replacing existing masonry with new masonry materials.

2. Rake-out existing mortar from joints indicated to be repointed.

3. Repoint existing mortar joints of masonry indicated to be restored.

4. Clean existing masonry surfaces.

PART 2 PRODUCTS

2.1 MASONRY MATERIALS

A. For mortar materials, conform to the requirements of Section 042000.

2.2 MORTAR MIXES

A. Measuring and Mixing: Measure cementitious and aggregate material in a dry condition by volume or equivalent weight. Do not measure by shovel, use known measure. Mix materials in a clean mechanical batch mixer.

1. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix which will retain its
2. Rake out mortar from joints to depths equal to 2-1/2 times their widths but not less than 1/2" nor less than that required to expose sound, unweathered mortar.

3. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum or flush joints to remove dirt and loose debris.

4. Do not spall edges of masonry units or widen joints. Replace any masonry units which become damaged.

    a. Cut out old mortar by hand with chisel and mallet.
    b. Power operated rotary hand saws and grinders will be permitted but only on specific written approval of Architect based on submission by Contractor of a satisfactory quality control program and demonstrated ability of operators to use tools without damage to masonry. Quality control program shall include provisions for supervising performance and preventing damage due to worker fatigue.

B. Joint Pointing

1. Rinse masonry joint surfaces with water to remove any dust and mortar particles. Time application of rinsing so that, at time of pointing, excess water has evaporated or run off, and joint surfaces are damp but free of standing water.

2. Apply first layer of pointing mortar to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8" until a uniform depth is formed. Compact each layer thoroughly and allow to become thumbprint-hard before applying next layer.

3. After joints have been filled to a uniform depth, place remaining pointing mortar in three (3) layers with each of first and second layers filling approximately 2/5 of joint depth and third layer the remaining 1/5. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing bricks have rounded edges recess final layer slightly from face. Take care not to spread mortar over edges onto exposed masonry surfaces, or to featheredge mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints, unless otherwise indicated. Remove excess mortar from edge of joint by brushing.

5. Cure mortar by maintaining in a damp condition for not less than seventy- two (72) hours.

6. Where repointing work precedes cleaning of existing masonry allow mortar to harden not less than thirty (30) days before beginning cleaning work.

END OF SECTION 040120

SECTION 040140.61 - STONE REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes repairing stone masonry.

1.2 DEFINITIONS

A. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **Project site**.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of replacement stone units on the structure and their jointing.
2. Show provisions for expansion joints or other sealant joints.
3. Show replacement and repair anchors, including drilled-in pins.

C. Samples: For each exposed product and for each color and texture specified.

1.5 QUALITY ASSURANCE

A. Stone Repair Specialist Qualifications: Engage an experienced stone repair firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing standard unit masonry or new stone masonry is insufficient experience for stone repair work.

B. Mockups: Prepare mockups of stone repair to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.

1. Stone Repair: Prepare sample areas for each type of stone indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches (1200 mm) in least dimension. Construct sample areas in locations in existing walls where directed by Architect unless otherwise indicated. Demonstrate quality of materials, workmanship, and blending with existing work.

PART 2 - PRODUCTS

2.1 STONE MATERIALS

A. Stone Matching Existing: Natural building stone of variety, color, texture, grain, veining, finish, size, and shape that match existing stone.

1. Physical Properties for Bluestone

a. Compressive Strength: minimum 7,500 psi according to ASTM C170/C170M.
b. Modulus of Rupture: 1,000 psi according to ASTM C99/C99M.
c. Absorption: not to exceed 1% of weight according to ASTM C97/C97M.
d. Bulk Specific Gravity: 2.7 according to ASTM C97/C97M.

2. For existing stone that exhibits a range of colors, texture, grain, veining, finishes, sizes, or shapes, provide stone that proportionally matches that range rather than stone that matches an individual color, texture, grain, veining, finish, size, or shape within that range.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; white[**or gray, or both**] where required for color matching of mortar.

1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Masonry Cement: ASTM C91/C91M.

D. Mortar Cement: ASTM C1329/C1329M.

E. Mortar Sand: ASTM C144.

1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.

2. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
3. Use formulation that is vapor and water permeable (equal to or more than the stone), exhibits low shrinkage, has lower modulus of elasticity than stone units being repaired, and develops high bond strength to all types of stone.
4. Formulate patching compound in colors, textures, and grain to match stone being patched.

F. Cementitious Crack Filler: Ultrafine superplasticized grout that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all types of stone.

2.3 ACCESSORY MATERIALS

A. Setting Buttons and Shims: Resilient plastic, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units, less the required depth of pointing materials unless removed before pointing.

B. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:

1. Previous effectiveness in performing the work involved.
2. Minimal possibility of damaging exposed surfaces.
3. Consistency of each application.
4. Uniformity of the resulting overall appearance.
5. Do not use products or tools that could leave residue on surfaces.

2.4 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.

C. Do not use admixtures in mortar unless otherwise indicated.

PART 3 - EXECUTION

3.1 PROTECTION

A. Remove associated hardware adjacent to stone and store during stone repair. Reinstall when repairs are complete.

1. Provide temporary rain drainage during work to direct water away from building.

3.2 STONE REMOVAL AND REPLACEMENT

A. At locations indicated, remove stone that has deteriorated or is damaged beyond repair **or is to be reused**. Carefully remove entire units from joint to joint, without damaging surrounding stone, in a manner that permits replacement with full-size units.

B. Support and protect remaining stonework that surrounds removal area.

C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing stone or unit masonry backup, rotted wood, rusted metal, and other deteriorated items.

E. Remove in an undamaged condition as many whole stone units as possible.

1. Remove mortar, loose particles, and soil from stone by cleaning with hand chisels, brushes, and water.
2. Remove sealants by cutting close to stone with utility knife and cleaning with solvents.

F. Clean stone surrounding removal areas by removing mortar, dust, and loose particles in preparation for stone replacement.

G. Replace removed damaged stone with other removed stone in good condition, where possible, matching existing stone, including direction of rift or natural bedding planes. Do not use broken units unless they can be cut to usable size.

H. Install replacement stone into bonding and coursing pattern of existing stone. If cutting is required, use a motor-driven saw designed to cut stone with clean, sharp, unchipped edges. Finish edges to blend with appearance of edges of existing stone.

1. Maintain joint width for replacement stone to match existing joints.
2. Use setting buttons or shims to set stone accurately spaced with uniform joints.

I. Set replacement stone with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter vertical joints for full width before setting, and set units in full bed of mortar unless otherwise indicated. Replace existing anchors with new anchors matching existing configuration.

1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing stonework.
2. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.

J. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.3 STONE-FRAGMENT REPAIR

A. Carefully remove cracked or fallen stone fragment indicated to be repaired. Reuse only stone fragment that is in sound condition.

B. Remove soil, loose particles, mortar, and other debris or foreign material from fragment surfaces to be bonded and from parent stone where fragment had broken off, by cleaning with stiff-fiber brush.

C. Pinning: Before applying adhesive, prepare for mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled at a 45-degree downward angle through face of fragment and into parent stone.

D. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled into parent stone and into, but not through, the fragment.

E. Apply stone-to-stone adhesive according to adhesive manufacturer's written instructions. Coat bonding surfaces of fragment and parent stone, completely filling all crevices and voids.

F. Fit stone fragment onto parent stone while adhesive is still tacky and hold fragment securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of fragment with face of parent stone.

3.4 CRACK INJECTION

A. General: Comply with cementitious crack-filler manufacturer's written instructions.

B. Drill 1/4-inch- (6-mm-) diameter injection holes as follows:

1. Transverse Cracks Less Than 3/8 inch (9 mm) Wide: Drill holes through center of crack at 12 to 18 inches (300 to 500 mm) o.c.
2. Transverse Cracks More Than 3/8 inch (9 mm) Wide: Drill holes through center of crack at 18 to 36 inches (500 to 900 mm) o.c.
3. Delaminations: Drill holes at approximately 18 inches (500 mm) o.c. both vertically and horizontally.
4. Drill holes 2 inches (50 mm) deep.

C. Clean out drill holes and cracks with compressed air and water. Remove dirt and organic matter, loose material, sealants, and failed crack repair materials.

D. Place plastic injection ports in drilled holes and seal face of cracks between injection ports with clay or other nonstaining, removable plugging material. Leave openings at upper ends of cracks for air release.

E. Inject cementitious crack filler through ports sequentially, beginning at one end of area and working to opposite end; where possible, begin at lower end of injection area and work upward. Inject filler until it extrudes from adjacent ports. After port has been injected, plug with clay or other suitable material and begin injecting filler at adjacent port, repeating process until all ports have been injected.

F. Clean cementitious crack filler from face of stone before it sets by scrubbing with water.

G. After cementitious crack filler has set, remove injection ports, plugging material, and excess filler. Patch injection holes and surface of cracks as specified in "Stone Patching" Article.

3.5 STONE PATCHING

A. Remove deteriorated material and remove adjacent material that has begun to deteriorate. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch (6 mm) thick, but not less than recommended in writing by patching compound manufacturer.

B. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of stone unit.

C. Brush-coat stone surfaces with slurry coat of patching compound according to manufacturer's written instructions.

D. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.

1. Simple Details: Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the stone. Shape and finish surface before or after curing, as determined by testing, to best match existing stone.
2. Carved Details: Build patch up 1/4 inch (6 mm) above surrounding stone, and carve surface to match adjoining stone after patching compound has hardened.

E. Keep each layer damp for 72 hours or until patching compound has set.

F. Remove and replace patches with hairline cracks or that show separation from stone at edges, and those that do not match adjoining stone in color or texture.

3.6 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low-pressure spray.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

END OF SECTION 040140.61

SECTION 042000

UNIT MASONRY

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the unit masonry work as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Concrete block walls and partitions.
2. Face brick.
3. Metal joint reinforcing, anchors, ties, weeps, closures and related accessories for masonry.
4. Control and expansion joints in masonry, filled with joint fillers.
5. Thru-wall flashing.
6. Mortar net.
7. Chases, recesses, pockets and openings in masonry as required for installation of work by others.
8. Building in of items furnished by others into masonry, including access doors, door frames, anchors, sleeves and inserts, and other similar items to be embedded in masonry.
9. Grouting in of metal items built into masonry work.
10. Protection, pointing and cleaning of masonry.

1.3 RELATED SECTIONS

A. Concrete - Section 033000.

B. Cast stone - Section 047200.

C. Cold formed metal framing - Section 054000.

D. Steel lintels - Section 055000.

E. Building insulation - Section 072100.

F. Metal flashing - Section 076200.

G. Firestops and smokeseals - Section 078413.

H. Sealant - Section 079200.

1.4 SUBMITTALS

A. Submit Samples for the following:

1. Each type of face brick in sufficient number and color (not less than 5) to show full range of color, texture and shade. Submit certification that brick meets ASTM standards specified herein.

a. Submit samples of all special shapes required showing color range and sizes.

2. Joint reinforcing, each type, width and proposed location (labeled).

3. Anchors, wedges and ties, each type, width and proposed location (labeled).

4. Joint filler, each type.

5. Flashing, including splice sample, 12" long.

6. Mortar color, 12" long cured sample.

B. Submit technical and installation information for the following:

1. Mortar materials, each material and mortar type.

2. Certification of mortar mix.

3. Flashing material, descriptive literature.

4. Concrete block, joint reinforcing, anchors, ties and joint filler; submit manufacturer's technical and descriptive literature.

5. Block manufacturer shall submit certifications of compliance with ASTM C 90, C 331 and UL 618 prior to any job site delivery. Field sampling of concrete block may be tested by an Independent Testing Laboratory retained by the Owner according to the requirements of ASTM C 140.

C. Construction Procedures (Submit the following)

1. Procedures and materials for cleaning masonry work; including certification that cleaner will not adversely affect stone, gaskets, sealants, etc.

1.5 QUALITY ASSURANCE

A. Conform to the following non-cumulative tolerances (any masonry work not meeting these standards shall be re-built as directed by the Architect).

1. Variation from the plumb:

a. In lines and surfaces of columns, walls and arrises:
1). In 10 feet 1/8"

2). In any story of 25 feet maximum 1/4"
3). In 40 feet or more 1/4"

b. For external corners, expansion joints and other conspicuous lines:
1). In any story of 25 feet maximum 1/4"
2). In 40 feet or more 3/8"

2. Variation from the level or the grades indicated on the drawings; for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:

a. In any bay or 20 feet maximum 1/4"
b. In 40 feet or more 1/4"

3. Variation of the linear building lines from established position in plan related portion of columns and partitions:

a. In any bay or 20 feet maximum 1/4"
b. In 40 feet or more 1/2"

4. Variation in cross-sectional dimensions of columns and in thickness of walls:

a. Minus 1/8"
b. Plus 1/8"

5. Variation in dimensions of masonry openings:

a. Horizontal dimension -0" + 1/16"
b. Vertical dimension +0" - 1/16"

B. Job Mock-Up

1. Prior to installation of masonry work, erect sample wall panel mock-up using materials, bonding patterns and joint tooling required for final work and including cavity wall, masonry sill, typical pier with returns and stone base, window unit and sill, projecting courses, anchors and reinforcement as detailed. Provide special features as directed by the Architect for caulking and contiguous work. Build mock-up at the site, 4' x 4' size as directed by the Architect, indicating the proposed range of colors, textures and workmanship to be expected in the completed work. Reconstruct mock-up if directed by the Architect until it meets with Architect's approval. Obtain Architect's acceptance of visual qualities of the mock-up before start of masonry work. Retain mock-up during construction as a standard for judging completed masonry work. Do not alter, move or destroy mock-up until work is completed and accepted by the Architect. Use sample panels to test proposed cleaning procedures after sample panel meets with Architect's approval.

2. Approved sample panel shall remain on view at the site until completion of face brick work and shall establish the technical and aesthetic standards for the Project.

3. Architect shall direct distribution of brick color and texture variation within mock-up.

C. Factory Control

1. The Architect reserves the right to visit the brick manufacturer's facility and review pre-sorting so that all brick falls within a color range acceptable to the Architect.

2. 4' x 4' mock-ups shall be constructed at the factory using the face brick specified. This mock-up, after approval of the Architect, shall become the quality control panel for the selected brick.

3. Prior to any shipment of the face brick from the factory, the Architect reserves the right to inspect the brick for the thoroughness of the pre-sorting and to reject any brick which in his opinion do not fall within acceptable color range.

D. Work of this Section shall conform to the requirements of the following (unless otherwise superseded by prevailing Building Code):

1. 2008 ACI 530/ASCE 5/TMS 402 Building Code Requirements for Masonry Structures.

2. 2008 ACI 530-1/ASCE 6/TMS 602 Specifications for Masonry Structures.

3. Brick Industry Association (BIA) "Technical Notes on Brick Construction."

E. Pre-Construction Conference: Prior to installation of masonry and associated work, Contractor shall arrange a meeting with Masonry Subcontractor, installers of related work, and other entities concerned with masonry wall performance, including the Architect and Owner. Contractor shall record discussions and agreements and furnish copy to each participant. Provide at least seventy-two (72) hours' advance notice to participants prior to convening conference. Review methods and procedures related to masonry work, including, but not limited to, the following:

1. Review masonry requirements (drawings, specifications and other Contract Documents).

2. Review required submittals, both completed and yet to be completed.

3. Review and finalize construction schedule related to masonry work and verify availability of materials, installer’s personnel, equipment and facilities needed to make progress and avoid delays.

4. Review required inspection, testing, certifying and material usage accounting procedures.

5. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

6. Coordinate work with air/vapor barrier membrane and related flashing, review details to avoid conflicts.

1.6 PRODUCT HANDLING

A. General: Deliver, store, handle and protect all materials from damage, moisture, dirt and intrusion of foreign matter. Store all masonry units and mortar materials on raised

platforms and under ventilated and waterproof cover. Store packaged materials in manufacturer's unopened containers, marked with manufacturer's name and product brand name. Immediately reseal containers after partial use. Remove and replace damaged materials.

B. Masonry Units: Pack, deliver and store to prevent breakage, cracking, chipping, spalling

or other damage. Store, protect and ventilate units at project site.

C. Aggregate: Store with provisions for good drainage.

D. Reinforcement and Anchors: Store and protect so that when placed, joint reinforcement and anchors will be free of soil, dirt, ice, loose rust, scale, or other coatings which would destroy or reduce bond with mortar, and will not be disfigured or bent out of shape.

1.7 CODE REQUIREMENTS

A. Work of this Section shall conform to all applicable requirements of the State of New Jersey Building Code.

1.8 TESTING FOR EFFLORESCENCE

A. Test selected face brick for efflorescence in accordance with ASTM C 67.

B. If, at the end of the test period, the samples of brick or mortar show efflorescence, the materials represented shall be rejected and new materials shall be re-tested. This process shall be repeated until no efflorescence appears. Testing shall be done by an independent testing laboratory at the expense of the Contractor; submit test results in writing to the Architect.

1.9 JOB CONDITIONS

A. In cold weather, when the outside temperature is below forty (40) degrees F., conform to the requirements of "Cold Weather Masonry Construction and Protection Recommendations" publication by Brick Industry Association (BIA). No anti-freeze admixtures are permitted.

1. In addition, conform to the following:

a. Masonry materials must be warmed as required.
b. Brickwork must be protected a minimum of 24 hours after installation so as to maintain enough heat for hydration of the cement in the mortar.

B. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg. F. and above. In addition, conform to the following:

1. Masonry materials must be cool.

2. Mortar must be used within 2 hours of initial mixing.

C. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24" down both sides and hold cover securely in place.

2. Where one wythe of multi-wythe masonry walls is completed in advance of other

wythes, secure cover a minimum of 24" down face next to unconstructed wythe and hold cover in place.

D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.

1.10 ATTIC STOCK

A. Provide additional 10% of dry mortar mix labeled, packaged and delivered to location determined by Owner for attic stock.

B. Provide additional 5% of brick labeled, packaged and delivered to location determined by Owner for attic stock.

PART 2 PRODUCTS

2.1 MATERIALS

A. Standard Concrete Block

1. Portland cement, ASTM C 150, Type 1, low alkali (less than 65) one source.

2. Aggregates, ASTM C 331, lightweight expanded shale, clay or slate aggregates, manufactured by the rotary kiln process equal to "Solite," "Norlite," or "Haydite."

a. Block scheduled to receive painted finish shall contain normal weight aggregate meeting ASTM C-33 in addition to light weight aggregate in order to receive a smooth, uniform finish.

3. Concrete Masonry Units: Load bearing lightweight aggregate concrete masonry units conforming to the requirements of ASTM C 90.

a. Block behind face brick and block for rated walls shall be 75% solid units.
b. All other block may be hollow units.

4. The producer of the concrete masonry units shall furnish certification from an independent testing laboratory confirming that all 8" or larger masonry units meet all of the UL 618 requirements for two (2) hours or better (as required), referencing full scale fire test reports (ASTM E 119). All 4" and 6" units shall conform to "National Bureau of Standards" and "National Research Council" full scale fire tests.

5. Sizes and Shapes: Nominal face size 8" x 16" by thickness as indicated on drawings,

with stretcher units, jamb units, header units, square corner units (at ends and corners of exposed or painted work), sash units (at control joints within masonry wall), lintel units and other special shapes and sizes required to complete the work.

6. Finish: For exposed or painted block surfaces, in addition to ASTM requirements, block shall have uniformly dense, flat, fine grain texture, with no cracks, chips, spalls, or other defects which would impair appearance. For concealed CMU, surfaces shall be free from deleterious materials that would stain plaster or corrode metal.

7. Curing: All concrete block shall be steam cured, and air dried for not less than thirty (30) days before delivery.

8. Density of concrete block shall not exceed one hundred and five (105) lbs. per cubic foot.

9. Shrinkage: Shrinkage of concrete blocks shall not exceed 0.065% when tested in accordance with ASTM C 426-99.

10. Water Content

    a. At the time of delivery to the job site, concrete masonry units shall have a value, in weight of contained water, of not more than thirty (30) percent of the fully saturated content for the unit tested.
    b. Ship all units from the factory, and store at the job site, with all necessary protection to prevent increase of water content from rain and other sources.

B. Brick

1. Size: Unless otherwise indicated, provide modular bricks size as follows - 3-5/8" h. x 2-1/4" th. x 7-5/8" w.

2. Facing Brick: ASTM C 216, Grade SW, Type FBX, equal to _____.

3. Where brick is fully concealed provide common brick conforming to ASTM C 62, Grade SW.

4. Provide all special molded shapes as indicated on the drawings.

5. For sills, caps and similar applications resulting in exposure of brick surfaces which otherwise would be concealed from view, provide uncored units with all exposed surfaces finished.

C. Joint Reinforcing for Masonry Walls

1. Non-Seismic Construction: For anchoring face brick to CMU back-up, provide welded "ladder" design, of 3/16" dia. gauge steel rods with adjustable 3/16" wire rectangular pintle anchors fastened to reinforcement 16" o.c. Provide special formed prefabricated pieces at corners and intersections of walls or partitions. Anchors to extend at least 2" into face of brick. Show anchor locations on approved shop drawings. Joint reinforcing shall be equal to Ladder Type 270 with "Lox All Adjustable Anchor" made by Hohmann & Barnard or equal manufactured noted below in Para. C.6.

    a. Reinforcing assembly shall have hot dip galvanized steel finish conforming to ASTM A 153 with zinc coating of 1.5 oz. of zinc per sq. ft. after fabrication.

2. Seismic Construction: For anchoring face brick to CMU back-up, provide No. 280 "S.I.S. Dub'l Loop-Lock Ladder Seismiclip Interlock System" made by Hohmann & Barnard or equal by manufacturer noted below in Para. C.6. All wire used in assembly shall be 3/16" dia. Assembly shall contain ladder reinforcing, welded loops, box tie, seismiclip and continuous wire in face brick mortar joint. Provide special formed prefabricated pieces at corners and intersections of walls or partitions. Reinforcing wire in face brick mortar joint to extend at least 2" into face of brick. Show anchor locations on approved shop drawings.

    a. Reinforcing assembly shall be hot dip galvanized steel finish conforming to ASTM A 153 with zinc coating of 1.5 oz. of zinc per sq. ft., after fabrication.

3. For block walls forming part of exterior wall construction behind exterior stone veneer, provide super heavy duty reinforcing fabricated of 3/16" dia. side and cross rods, truss or ladder design, ties, spaced every block course. Provide prefabricated pieces at corners and intersections of walls or partitions.

    a. Reinforcing assembly shall be hot dip galvanized steel finish conforming to ASTM A 153 with zinc coating of 1.5 oz. of zinc per sq. ft., after fabrication.

4. For interior block walls and partitions, provide standard reinforcing fabricated of 9 ga. side and cross rods, truss or ladder design, no ties, spaced every other block course. Provide prefabricated pieces at corners and intersections of walls or partitions. Reinforcing shall be mill galvanized conforming to ASTM A 641, Class B-1, applied after fabrication.

5. Wire used in assemblies noted above shall be cold drawn steel wire conforming to ASTM A 82.

6. Approved Joint Reinforcing Manufacturer: Hohmann & Barnard, or approved equal.

D. Anchors and Ties

1. For anchoring brick to cold formed metal framing, provide one of the following or approved equal by other manufacturers noted above in Para. C.6:

    a. "Wing-Nut Pos-I-Tie®" with self-drilling screw for steel studs zinc barrel and thermal wing-nut as manufactured by Heckmann Building Products. Provide Seismic Wire Pintle Tie hot-dip galvanized steel.
    b. Hot-dip galvanized steel anchors equal to "X-Seal Veneer Anchor" with "X-Seal Tape" as manufactured by Hohman & Barnard or approved equal. Provide Model 187 "Seismiclip" with 9 ga. Wire.

2. Dovetail Anchor Slots: Hot-dip galvanized steel, 16 gauge equal to No. 100 Dovetail Anchor Slot made by Heckmann Building Products, No. 305 anchor slot made by Hohmann & Barnard, or approved equal by other manufacturers in Para. C.6.

3. Flexible Metal Ties for Dovetail Slots: Hot-dip galvanized, 16 gauge by 1" wide by Heckmann Building Products Inc., or approved equal manufacturer noted above in Para. C.6.

    a. No. 106 Dovetail Corrugated Anchor.
    b. No. 129 Dovetail Triangle Tie.

4. Wire Mesh: Hot-dip galvanized sixteen (16) gage steel wire, square mesh, width 3" by length to suit condition; No. 268 by Heckmann Building Products, or approved equal by manufacturer noted above in Para. C.6.

5. For anchoring face brick to concrete back-up where there are no dovetail slots provided, provide "CMU/Concrete Screw Wing-Nut Pos-I-Tie®" with five (5) gauge hot-dip galvanized (ASTM A 153, Class B-2) wire pintle tie made by Heckmann Building Products, or approved equal by manufacturer noted above in Para. C.6.

6. For anchoring CMU wall, at the exterior masonry cavity wall, to the underside of the concrete beam, provide dovetail slot as noted above and the following:

   a. No. 121 galvanized steel dowel anchor and No. 421 tube as manufactured by Heckmann Building Products or approved by manufacturer noted above in Para. C.6. Galvanized to conform to ASTM A 153, Class B-2.
   b. No. PTA-310 galvanized steel dowel anchor and No. NS-TA joint filler as manufactured by Hohmann & Barnard or approved equal by manufacturer noted above in Para. C.6. Galvanizing to conform to ASTM A 153, Class B-2.

7. For anchoring masonry to structural steel, provide hot-dip galvanized steel, as listed, or approved equal by manufacturer noted above in Para. C.6:

   a. Made by Heckmann Building Products. Galvanizing shall conform to ASTM A 153, with zinc coating of 1.5 oz. of zinc per sq. ft.
      1). No. 195 Column Anchors
      2). No. 197 Column Anchors
      3). No. 315 Weld-On Anchor Rods with No. 316 Triangle Ties
      4). No. 315-B Weld-On Anchor Straps with No. 316 Triangle Ties

   b. Made by Hohmann & Barnard or approved equal. Galvanizing shall conform to ASTM A 153, with zinc coating of 1.5 oz. of zinc per sq. ft.
      1). No. 355 Column Anchors
      2). No. 356 Column Anchors
      3). No. 357 Beam Anchors
      4). No. 359 F anchor straps with VWT tie.

8. For anchoring CMU interior partitions to underside of steel beams, provide hot dip galvanized steel tube anchors equal to No. 419 and No. 421 made by Heckmann Building Products, No. PTA-420 made by Hohmann & Barnard, or approved equal by manufacturer noted above in Para. C.6.

9. For anchoring CMU interior partitions to underside of structural deck, provide 4" x 4" x 1/4" galvanized steel angles (ASTM A 36), 3'-0" long spaced 3'-0" o.c. alternately on each side of partition. Anchor partition securely to structural deck.

E. Reinforcing Bars and Rods: ASTM A 615, Grade 60. See Drawings for size.

F. Control and Expansion Joint Fillers

1. Vertical Installation Within Concrete Masonry Wall: Extruded high grade neoprene rubber, cross shape, for use with concrete masonry sash units, which shall provide a force fit in the grooves of the sash block, and shall have 1/2" diameter tubular ends (compressed 25% when installed in 3/8" wide joint).

a. Provide the following sizes:
   1). 2-5/8" wide control joint fillers for 4" block walls.
   2). 4-5/8" wide for 6" block walls.
   3). 6-5/8" wide for 8", 10" and 12" block walls.
b. Provide backer rod and sealant joint over joint filler as per drawings and Section 079200 of these specifications.

2. Isolation Joint Filler at Abutting Construction and at Intersecting CMU Walls: Compressible and resilient closed cell neoprene gasket with pressure sensitive adhesive backing, thickness 30% greater than thickness of joint. Acceptable joint filler shall be "Everlastic, Type NN-1" by Williams Products, Inc., or approved equal. Recess joint filler and install backer rod and sealant as per drawings and Section 079200 of these specifications.

3. Within Face Brick: Provide filler rod and sealant installed by Section 079200. Filler depth shall be 2 times joint width.

   a. Compressible filler between top of brick and bottom of shelf angle or steel lintel shall be “Soft Joint Sealant” made by Polytite, or approved equal.

4. Within Expansion Joint at Face Brick: Manufacturer’s standard preformed, pre- compressed, open-cell polyurethane foam sealant impregnated with a water based, non-drying polymer modified acrylic water repellent. Provide “Seismic Colorseal” installed to twenty-five 25 percent compression, as manufactured by Emseal or approved equal.

   a. Properties: Permanently elastic, mildew resistant, non-migratory, non-staining, and compatible with joint substrates and other joint sealants. Density: 8.4 to 9.1 lb./cu. ft..

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type 1, standard color, one source.

B. Hydrated Lime: ASTM C 207, Type S, as manufactured by Corsons, or approved equal.

C. Aggregate: Clean, washed, buff colored sand, graded per ASTM C 144.

D. Aggregate for Grout: ASTM C 404.

E. Water: Clean, fresh and suitable for drinking.

2.3 MORTAR MIX

A. Exterior Face Brick Construction: Mortar mixes shall meet ASTM C 270, Type N, cement/lime mortar. Colors of mortars shall use coloring agent made by Davis Colors, Lehigh Cement or approved equal. Color of mortar to meet with Architect's approval. The Contractor may use pre-packaged colored mortar equal to "Color Mortar Blend" made by Glen-Gery.

   1. Color of mortar must meet with Architect’s approved sample and mock-up panel.

B. Exterior Block Back-Up Construction: Provide Portland cement/lime mortar as noted above conforming to ASTM C 270, Type N.

C. Interior Masonry Construction: Provide Portland cement/lime mortar conforming to ASTM

C 270, Type N, for load bearing conditions, mortar shall conform to ASTM C 270, Type M.

D. Reinforced Concrete Block: Provide Portland cement/lime mortar conforming to ASTM C 270, Type S.

E. Mortar for Cement Cants: One (1) part Portland cement and four (4) parts sand, by volume.

F. Grout for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of unit masonry. Use grout of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout. Grout shall have a minimum compressive strength of 3000 psi when tested in accordance with ASTM C 1019.

G. Mixing

1. General: Add cement just before mixing and mix dry. Use sufficient amount of water as necessary to produce workable mix. Mix in small batches to make plastic mass.

2. Mixing: Machine mix all mortars in approved type mixer with device to accurately and uniformly control water. Add hydrated lime dry. Mix dry materials not less

than two (2) minutes. Add water, then mix not less than three (3) minutes, not to exceed five (5) minutes. Mix only amount of mortar that can be used before initial set. Do not use mortar which has reached its initial set or two (2) hours after initial mixing, whichever comes earlier. Mortar may not be re-tempered. Clean mixer for each batch, whenever mortar type is changed, and at end of each day's work.

3. Acceleration or other admixtures not permitted.

4. Mortar shall have a flow after suction of not less than seventy-five (75) percent of that immediately after mixing as determined by ASTM C 91.

H. Admixtures

1. No air-entraining admixtures or cementitious materials containing air-entraining admixtures shall be used in the mortar.

2. No antifreeze compounds or other substances shall be used in the mortar to lower the freezing point.

3. Calcium chloride or admixtures containing calcium chloride shall not be used in mortar.

2.4 WEEP HOLES

A. Provide clear plastic weep holes 3/8" wide and 1-1/2" high by four (4) inches long equal to No. 342 made by Hohmann & Barnard or approved equal manufacturer listed above.

2.5 THRU-WALL FLASHING

A. Provide sheet membrane flashing as part of exterior wall membrane system. Provide sealants and tapes as recommended by the manufacturer. Provide preformed corner sections "end dams" with system when flashing is discontinuous.

1. Provide flashing for surface adhered applications at sheathed areas with 26 ga.

stainless steel termination bar.

2. Wall flashing shall have 26 ga. stainless steel drip edge adhered to edge of flashing, drip edge shall be set in sealant as specified in Section 079200.

2.6 MORTAR NET

A. Provide 10" high HDPE "Mortar Net" open mesh mortar net of width to fit masonry cavity shown on drawings, manufactured by Hohmann & Barnard, or equal "Mortar Break II," made by Advanced Building Products.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that masonry may be completed in accordance with all pertinent codes and regulations, the referenced standards, and the original design.

3. Do not start any work until mock-ups are approved by the Architect.

B. Discrepancies

1. In the event of discrepancy, immediately notify the Architect in writing.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3. Starting of work by the Contractor means acceptance by the Contractor of the substrate.

3.2 COORDINATION

A. Carefully coordinate with all other trades to ensure proper and adequate interface of the work of other trades with the work of this Section.

3.3 PREPARATION

A. Brick

1. Wet brick having an initial rate of absorption greater than 30 grams per 30 square inches when tested per ASTM C67. Wet bricks by allowing water to run on the cubes or pallets of brick, or placing them in a large tank of water.

2. Except for absorbent units specified to be wetted, lay masonry units dry.

B. Concrete Block: Do not wet concrete block units.

3.4 INSTALLATION

A. General

1. Build walls to the full thickness shown. Build single wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown.

2. Build chases and recesses as shown or required for the work of other trades.

3. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

4. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement type joints, returns and off-sets. Avoid the use of less than half size units at corners, jambs and wherever possible.

5. Lay up walls plumb and true with courses level, accurately spaced and coordinated with other work.

6. Provide templates made of steel studs for plumbing of two story masonry openings.

7. Pattern Bond: Lay exposed masonry patterns as noted on drawings. If not shown, provide running bond. Lay concealed concrete block with all units in a wythe bonded by lapping not less than two (2) inches. Bond and interlock each course of each wythe at corners. Do not use units of less than four (4) inches horizontal face dimensions at corners or jambs.

8. Where possible, masonry walls and partitions shall be built after all overhead ducts, pipes and conduits are in place and tested. Masonry shall be neatly built around the items above. Walls and partitions shall be plumb, true to line and free from defects such as open cells, voids, dry joints and other similar defects. In rooms and spaces scheduled to have concrete block finish, all such surfaces including upper wall surfaces up to termination of structural ceiling in spaces without suspended ceilings, shall be made suitable for paint application. Cutting of openings in walls and partitions in place shall be done only with the approval of the Architect.

9. Do not use any brick that do not meet chippage and tolerances of the applicable ASTM standard noted herein for the grade, type or class of brick.

10. Mortar, ties and reinforcement must not extend into or bridge any expansion joints.

B. Mortar Bedding and Jointing

1. All joints between bricks shall be completely filled with mortar. Bed joints shall be beveled per BMI recommendations, with the brick then shoved in place. At cavity wall construction, care shall be taken that no excess mortar goes into masonry cavity. Head joints shall be completely filled with mortar and shall be formed by applying a full coat of mortar to the entire end or the entire side, as the case requires, and then shoving the mortar covered end and/or side of the brick tightly against the bricks previously laid; the practice of “slushing” by throwing mortar into the head

joints will not be permitted. All brick shall be laid without disturbing the brick previously laid. Brick shall be laid within a minute or so after the mortar is placed. Dry or butt joints will not be permitted. Grouting shall be done only as necessary. Do not slush head joints.

2. After brick placement, mortar squeezed out of bed joints shall be cut off before tooling.

3. Lay concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on exterior walls and in all courses of piers, columns and pilasters, where solid CMU is used and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.

   a. To ensure alignment of brick and block coursing, adjust block back-up by cutting block to ensure alignment of coursing or use adjustable anchorage.

4. Lay masonry walls with 3/8" joints unless otherwise shown on drawings.

5. Tool exposed joints slightly concave after the mortar joint is “thumbprint” hard. Concealed joints shall be struck flush, including at any CMU schedule to receive a waterproofing or air barrier membrane.

6. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

C. Stopping and Resuming Work: Rake back 1/2 brick length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.

D. Built-In Work

1. As the work progresses, build in items specified under this and other Sections of these specifications. Fill in solidly with masonry around built-in items.

2. Mortar in door frames, access doors, louvers and other metal items embedded or built into masonry work solidly with mortar as the masonry units are laid up.

3. Grout under lintels, bearing plates, and steel bearing on masonry with solid bed grout.

4. Sleeves, pipes, ducts and all other items which pass through masonry walls shall be caulked with interior grade sealant meeting requirements of Section 079200, so as to be air tight and prevent air leakage. Refer to Section 078413 for packing of voids in rated masonry walls.

5. Fill vertical cells of masonry units solid with grout which have anchoring, reinforcing rods, supporting or hanging devices embedded in the cell including stone anchors and window or curtain wall anchors.

6. Fill vertical cells of masonry units solid with mortar on each side of door frames to sixteen (16) inches beyond.

7. Unless otherwise noted, fill vertical cells of masonry units solid with grout which are

below steel bearing plates, steel beams, and ends of lintels, to eight (8) inches beyond bearing and from floor to bearing.

8. Place wire mesh in horizontal joint below masonry unit cells to be filled with mortar, to prevent mortar from dropping into unfilled cells below.

9. Masonry indicated as being reinforced shall have all voids filled solid with grout. Grout shall be consolidated in place by vibration or other methods which ensure complete filling of cells. When the least clear dimension of the grouted cell is less than two (2) inches, the maximum height of grout pour shall not exceed twelve (12) inches. When the least clear dimension is two (2) inches or more, maximum height of grout pour shall not exceed forty-eight (48) inches. When grouting is stopped for one (1) hour or longer, the grout pour shall be stopped 1-1/2" below the top of a masonry unit. Vertical bar reinforcing shall be accurately placed and held in position while being grouted, and shall be in place before grouting starts. All such reinforcing shall have a minimum clear cover of 5/8". Lap all bars a minimum of forty (40) bar diameters and provide steel spacer ties (not to exceed 192 bar diameter) to secure and position all vertical steel and prevent displacement during grouting. Provide continuous horizontal reinforcement embedded in mortar joints every second course.

E. Cutting and Patching

1. All exposed masonry which requires cutting or fitting shall be cut accurately to size with motorized carborundum or diamond saw, producing cut edges.

2. Do not saw cut any masonry openings in face brick construction without Architect's approval and after a procedure has been reviewed and approved.

3. Holes made in exposed masonry units for attachment of handrail brackets and similar items shall be neatly drilled to proper size.

4. All masonry which requires patching in exposed work, if approved by Architect, shall be patched neatly with mortar to match appearance of masonry as closely as possible and to the Architect's satisfaction. Rake back joints and use pointing mortar to match as required.

F. Solid Wall Construction

1. Fill the vertical longitudinal joint between wythes solidly with mortar by parging the in-place wythe and shoving units into the parging.

2. Tie wythes with continuous horizontal reinforcement embedded in mortar joints sixteen (16) inches o.c. vertically.

G. Cavity Walls

1. All exterior masonry walls, unless otherwise indicated, shall be cavity walls of thickness indicated.

2. Two wythes of masonry cavity walls shall be securely tied together by horizontal joint reinforcement and ties anchored to reinforcement, as herein specified, spaced every other block course.

a. Where cavity back-up is concrete use ties specified herein spaced sixteen

(16) inches o.c. both directions.

3. Cavity between facing and backing wythe shall be kept clean and clear of all mortar droppings, and no mortar ledges shall project into the cavity. Temporary wood strips, cut to width of cavity and fitted with lift-up wires, shall be laid on the joint reinforcement and carefully lifted out before placement of the next layer of reinforcement. Any projecting mortar shall be spread over the back of the outer wythe immediately following the setting of the masonry unit.

   a. Mortar net shall be installed at the bottom of each cavity over the flashing to protect weep holes.

4. At cavity and solid walls adjacent to window openings fill block solid with mortar where window anchors are to be located. Coordinate with window subcontractor.

5. Concrete block back-up at cavity wall construction shall be anchored to slab at top with dovetail anchors spaced sixteen (16) inches o.c.

6. Anchor CMU back-up with anchors as specified herein.

7. Where stone veneer is used (Section 044200) in cavity wall configuration, back-up block shall be reinforced every block course.

8. Refer to Section 072100, "Thermal Insulation," for material and installation of cavity wall insulation.

H. Interior Block Partitions

1. Build to full height unless otherwise shown on drawings. At non-rated partitions fill void between CMU and structural deck with continuous neoprene filler conforming to the requirements of Section 079100. At fire rated partitions, fill void with fire stop material meeting the requirements of Section 078413. Fasten to structure at top of partition using steel angles as specified herein.

2. Provide continuous horizontal joint reinforcing every other block course, except as otherwise noted. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8". Lap reinforcement a minimum of six (6) inches at ends of units.

3. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

4. Corners

   a. Provide interlocking masonry unit bond in each course at corners.
   b. Provide continuity at corners with prefabricated "L" reinforcement units, in addition to masonry bonding.

5. Intersecting and Abutting Walls

   a. Unless vertical control joints are shown as part of structural frame, provide interlocking masonry bond. Provide starters and special shapes as shown on the drawings to bond these walls.

b. In addition to masonry bonding, provide horizontal reinforcement using prefabricated "T" units at interior partitions.

I. Ties and Anchors for Masonry Construction

1. Provide ties and anchors as shown or specified, but not less than one metal tie, spaced not to exceed sixteen (16) inches o.c. horizontally and/or vertically. Provide additional ties within 1'-0" of all openings and adjacent to expansion joints and spaced not more than 16" apart around perimeter of openings.

2. Anchor masonry to structure complying with the following:

a. Provide an open space not less than 1/2" in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.

3. Attach brick veneer to cold formed metal framing by anchoring brick to studs using specified anchors penetrating through sheathing and through flange of stud. Prior to application of anchors cover sheathing and vapor barrier with tape specified herein. Space anchors 8" o.c. at each stud; provide stainless steel screw anchors for attaching anchor to studs.

J. Control and Expansion Joints

1. Provide expansion, control and isolation joints in masonry as shown. Build in related items as the masonry work progresses.

2. CMU Control Joint Spacing: If location of control joints is not shown, place vertical joints spaced not to exceed 25'-0" o.c. In addition, locate joints at points of natural weakness in the masonry work, including the following:

a. At structural column or joint between bay.
b. Above control joints in the supporting structure.

c. Above major openings at end of lintels upward and below at ends of sills downward. Place at one side of jamb for openings less than 6'-0" wide and at both sides for openings over 6'-0" wide.
d. At reduction of wall thickness.
e. Where masonry abuts supporting structure.
f. If additional joints are required, indicate same on approved shop drawings.

3. Brick Veneer Expansion Joint Spacing: Vertical expansion joints in brick veneer construction shall be located maximum 20'-0" o.c. unless otherwise noted in addition to expansion joints located within 2'-0" of each corner of the building.

K. Lintels

1. Install loose steel lintels furnished by Section 055000, allowing eight (8) inch bearing at ends.

2. For concrete block walls, use specially formed U-shaped concrete block lintel units with reinforcing bars in accordance with the following table, filled with grout.

Number and Size of Reinforcing Bars Required at Concrete Block Lintels		
Maximum Clearance Span	Wall Width	Rebar No. - Size
2'-0" to 6'-0" 6'-0" to 8'-0"	6"	2 - #3 2 - #4
2'-0" to 6'-0" 6'-0" to 8'-0"	8"	2 - #3 2 - #4
2'-0" to 6'-0" 6'-0" to 8'-0"	12"	3 - #3 3- #4

3. U-shaped concrete block lintels shall extend a minimum of 8” at each side of opening.

3.5 FLASHING/WEEP HOLES

A. General: Install embedded flashing and weep holes in masonry at relieving angles, shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated. Space weeps 16" o.c. unless otherwise shown on drawings. Weeps shall occur immediately above the flashing.

B. Prepare masonry surfaces so that they are smooth and free from projections that could puncture flashing.

C. Flashing shall be placed, generally, at bottoms of cavity wall construction, over all wall openings, window jambs, at sills of window, and in other locations where indicated on

the drawings. Flashing shall overlap a minimum of 6". At bottoms of cavity walls, the flashing shall be built extending from the exterior face of the brick, up and into the mortar joint 2" at the inner wythe of the CMU back-up; at sheathed areas attached with pressure bar. At concrete spandrel beams and columns the flashing shall be installed with a termination bar. Extreme care shall be exercised in placing the masonry materials not to damage the flashing. Flashing damaged during the masonry erection shall be repaired or replaced by the Contractor at no additional cost to the Owner. Discontinuous flashing shall terminate with an end dam in a head joint, rising at least 1".

D. When spanning an air space, flashing shall be supported with a mortar wash, insulation or treated wood blocking.

E. Where flashing is penetrated by anchors, patch flashings at penetration using adhesive and mastic recommended by the manufacturer to ensure watertight seal.

F. Install flashing in accordance with manufacturer's instructions, using adhesive, primer, thinner, cleaner and mastic as recommended by flashing manufacturer.

1. Flashing shall overlap adjacent piece of flashing a minimum of 6".

G. Provide drip edge when flashing extends beyond face of brick.

3.6 CANTS

A. Provide specified mortar for cement cants at beams and other projections in elevator shafts, where adjoining wall is of masonry construction. Cants shall slope twenty (20) degrees from the horizontal.

3.7 CLEANING, PROTECTION, ADJUSTMENT

A. Protection

1. The Contractor shall take adequate precautions for the protection of all surfaces against mortar spatter, and shall immediately remove any such spatter should it inadvertently occur, leaving no stain or discoloration.

2. Excess mortar shall be wiped off the masonry surfaces as the work progresses.

3. Wood coverings shall be placed over all such masonry surfaces as are likely to be damaged during the progress of the entire project.

4. Protective measures shall be performed in a manner satisfactory to the Architect.

5. Damaged masonry units shall be replaced to satisfaction of the Architect.

6. Exterior masonry walls shall be draped with waterproof covering until copings are in place, to prevent water penetration in cavity.

B. Clean-Up

1. Upon completion, all exposed masonry shall be thoroughly cleaned following recommendations of the BIA Technical Note No. 20. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately 4' x 4' in a location approved by the Architect. No further cleaning work may proceed

until the sample area has been approved by the Architect, after which time the same cleaning materials and method shall be used on the remaining wall area. If stiff brushes and water do not suffice, the surface shall be thoroughly saturated with clear water and then scrubbed with a solution of an approved detergent masonry cleaner, equal to "Vana Trol" made by ProSoCo Inc. or equal made by Diedrich or approved equal, mixed and applied as per manufacturer's directions, followed immediately by a thorough rinsing with clear water. All adjacent non- masonry surfaces shall be thoroughly protected during cleaning.

a. Unless otherwise required by cleaning agent manufacturer use only low pressure device (30 to 50 psi) for application of cleaning agent and water rinsing.

C. Pointing: Point any defective joint with mortar identical with that specified for that joint.

END OF SECTION

SECTION 047200

CAST STONE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the cast stone as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Cast stone copings.

2. Mortar.

3. Anchors and accessories.

4. Joint filler.

1.3 RELATED SECTION

A. Unit Masonry - Section 042000.

B. Joint Sealers - Section 079200.

1.4 QUALITY ASSURANCE

A. Qualifications of Workmen

1. For the actual cutting and placing of cast stone units, use only skilled journeyman masons who are thoroughly experienced with the materials and methods specified and thoroughly familiar with the design requirements.

2. In acceptance or rejection of installed cast stone units, no allowance will be made for lack of skill on the part of workmen.

B. Manufacturer shall have a minimum of ten (10) years' experience in the manufacture of cast stone. Manufacturer's products must have previously been used on the exterior with satisfactory results. Manufacturer must have capability to produce cast stone on schedule and must be a member of the Cast Stone Institute.

C. Casting Tolerances: Maintain casting, bowing, warping and dimension tolerance within the following maximums:

1. Overall Dimension For Height and Width of Units: Plus zero of unit dimension to minus 3/32" for 10'-0" and over.

2. Twist, Bowing or Warping: Do not exceed length/360 or 1/8", whichever is greater.

3. Insert Locations: Place within plus or minus 1/8" in each direction.

4. Length of units shall not deviate by more than +/- 1/8" from approved dimensions.

D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1.	ASTM C 1364	Standard Specification for Architectural Cast Stone, except where more stringent standards are specified herein.
2.	ASTM C 150	Specification for Portland Cement.
3.	ASTM C 33	Specification for Concrete Aggregates
4.	ASTM C 979	Specification for Coloring Pigments for Integrally Pigmented Concrete.
5.	ASTM C 494	Specification for Concrete Admixtures
6.	ASTM A 615	Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
7.	ASTM C 1194	Test Method for Compressive Strength of Architectural Cast Stone.
8.	ASTM C 1195	Test Method for Absorption of Architectural Cast Stone.
9.	ASTM C 642	Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.
10.	ASTM C 39	Test Method for Compressive Strength of Concrete Cylinders.
11.	ASTM D 2244	Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

E. Testing: Test three specimens per 500 cubic feet at random from plant production in accordance with referenced standards.

F. Cold weather setting practices shall conform to the requirements specified in Section 042000.

1.5 SUBMITTALS

A. Submit samples of cast stone with documented independent testing laboratory reports to the Architect for approval.

B. Samples: Before any cast stone materials are delivered to the job site, submit twelve (12) inch long samples of each profile type cast stone unit required.

1. Submit 6" x 6" cast stone samples showing full range of colors and texture available.

C. Shop Drawings: Submit complete shop drawings of all cast stonework showing anchorage, type, location and spacing, joint fillers, mortar, and cast stone profiles, sizes, connections, location, type and size of reinforcing and adjacent construction.

1. The shop drawings shall show the setting mark of each stone and its location on the structure. The stone when delivered shall bear the same corresponding setting mark on an unexposed surface.

2. Shop drawings must show exact profiles for each piece.

D. Certification: Submit certification from an independent testing laboratory certifying to test results required under Article 1.4, Para. E. herein.

E. Provide structural calculations for connections prepared by a Professional Engineer licensed in the State of New Jersey, prepared in compliance with referenced documents and these specifications.

1.6 MOCK-UP

A. Provide full size unit(s) for use in construction of wall mock-up specified in Section 042000. The mock-up becomes the standard of workmanship for the project.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect cast stone and related materials before, during, and after installation, and to protect the installed work and materials of all other trades.

1. Stone shall be stored on skids, off the ground and covered with plastic sheeting; all material in contact with stone shall be non-staining.

B. Replacements: In the event of damage, immediately make all repairs and

replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 CAST STONE COLOR AND FINISH

A. Cast Stone used in this work shall match custom color and texture of samples approved by the Architect.

B. Exposed surfaces, unless otherwise specified, shall exhibit a typically fine grained texture similar to natural stone. No bug holes will be permitted and all facing material shall be mixed in a muller mixer.

C. The samples shall be approved by the Architect before the manufacturer proceeds with the work.

2.2 MANUFACTURER

A. All cast stone used in this work shall be manufactured by Rockcast (basis of design) or equivalent of Dura Art Stone Co., Continental Cast Stone Mfg. Inc., or approved equal, and conform to the following properties:

1. Compressive Strength, ASTM C 1194: 6500 psi min. for products at 28 days.

2. Absorption, ASTM C 1195 or ASTM C 642: 6% max. for products at 28 days.

3. Cumulative Percent Weight Loss (CPWL) shall be less than 5% after 300 freeze/thaw cycles when tested in accordance with ASTM C 1364.

4. Air Content: ASTM C 173 or C 231, for wet cast product only shall be 4-8%. Air entrainment is not required for dry cast products.

5. Linear Shrinkage: ASTM C 426: Shrinkage shall not exceed 0.065%.

6. Color Variation

   a. Must match color and finish of approved sample when viewed in direct daylight at a 5 foot distance.
   b. ASTM Color Variation Allowed: 2% hue; 6% lightness, chrome and hue combined.

2.3 MATERIALS

A. Cement shall be Portland Type I white, meeting ASTM C 150.

B. Fine aggregate shall be carefully graded and washed natural sands, or manufactured granite, marble, quartz or limestone sands meeting ASTM C 33, except that gradation may vary to achieve desired finish and texture.

C. Coarse aggregate shall be carefully graded and washed natural gravel, or crushed graded stone such as granite, marble quartz, limestone or other durable stone meeting ASTM C 33, except that gradation may vary to achieve desired finish and texture.

D. Coloring: All colors added shall be inorganic (natural or synthetic) iron oxide pigments meeting ASTM C 979 excluding the use of a cement grade of carbon black pigment, and shall be guaranteed by the manufacturer to be light fast and lime proof. The amount of pigment shall not exceed ten (10) percent by weight of the cement used. Colorant shall be manufactured by Davis Colors or approved equal.

E. Cast stone shall be reinforced with new billet steel reinforcing bars meeting ASTM A 615, grade 60, when necessary for safe handling, setting and structural stress, and the size of the reinforcing shall be as shown on approved shop drawings. If the surfaces are to be exposed to the weather, the reinforcement shall be galvanized or epoxy coated when covered with less than two (2) inches of material for bars larger than 5/8 inch and 1-1/2 inches for bars 5/8 inch or smaller. The material covering in all cases shall be at least twice the diameter of the bars. Stone shall be fully reinforced to take all stresses including handling, temperature changes and structural stress.

F. All anchors, dowels and other anchoring devices shall be furnished by the stone setter as shown on approved shop drawings using building stone anchors fabricated of Stainless Steel Type 304.

1. Anchors shall allow for wracking of the structure (seismic) without stressing the cast stone units.

2.4 FABRICATION

A. Provide shapes and sizes as indicated on drawings. Include custom cast corner units as indicated on drawings.

B. Cast stone, after being made, shall be cured as noted below in Article 2.5.

C. Cast stone shall be "dry cast" or "wet cast" (depending upon selected finish) to produce sharp arrises to match profiles on approved shop drawings. Provide stone with sinkages to receive anchors.

D. Cast stone for copings shall be fabricated to largest practical length, as shown on approved shop drawings.

E. Acid etch exposed surfaces as required to remove cement film prior to packaging and shipment. Sandblasting or chemical retardation finishing is not permitted.

2.5 CURING

A. Cure units in a warm curing chamber approximately 100 deg. F. at 95% relative humidity for approximately 12 hours, or cure in a 95% moist environment at a minimum 70 deg. F. for 16 hours after casting. Additional yard curing at 95% relative humidity shall be 350 degree days (i.e. 7 days at 50 deg. F. or 5 days at 70 deg. F. prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

2.6 ACCESSORIES

A. Mortar for setting of cast stone sections shall conform to ASTM C 270, Type N, with not more than 1/2 part lime per part of white non-staining Portland cement.

B. Joint Filler: Fill all joints with exposed tops with "Emseal" Greyflex Expanding Foam Sealant as manufactured by Emseal, Inc. or approved equal. Material shall be designed for compression in joint twenty-five (25) percent of its original width, depth of filler as per manufacturer's standard. Joint filler shall be recessed 3/4" from finished surface.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where cast stone is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Carefully coordinate with all other trades to ensure proper and adequate interface of the work of other trades with the work of this Section.

3.3 JOINTING

A. Joint Size: 3/8", unless otherwise noted.

B. Joint Material

1. Use a full bed of mortar at all bed joints.

2. Flush vertical joints full with mortar.

3. Leave all joints with exposed tops open for sealant.

C. Location of Joints: As shown on approved shop drawings.

3.4 SETTING

A. All cast stone shall be set by experienced stone masons, accurately and in accordance with the shop and setting drawings. All anchors and dowels shall be firmly placed and all anchor holes and dowel holes and similar holes filled completely with mortar.

B. Setting Tolerances: Plus/minus 1/32" allowable out of plane with adjacent units.

C. When setting with mortar, all stones not thoroughly wet shall be drenched with clear water just prior to setting.

D. All stone shall be protected from splashing mortar or damage by other trades. Any foreign matter splashed on the stone shall be removed immediately.

E. All joints with exposed tops shall be filled with joint filler specified herein recessed 3/4" from stone surface; balance of joint shall be filled with back-up rod and sealant by Section 079200.

3.5 PATCHING

A. The repair of chipped or damaged cast stone shall be done only by mechanics skilled in this class of work, with materials furnished by the manufacturer and according to his direction.

B. Patching will not be permitted on copings and any other piece which can be removed and replaced without undue difficulty. Replace such pieces which are chipped or damaged with identical new pieces. Reseal and/or repoint to remove any evidence of replacement.

C. Cast stone shall show no obvious repairs or imperfections other than minimal color variations when viewed with the unaided eye under good typical lighting at a ten (10) foot distance.

3.6 CLEANING

A. Before pointing, the face of all cast stone shall be scrubbed with a fiber brush, using soap powder and water and shall then be rinsed thoroughly with clean running water. Any mortar on the face of the cast stone shall be removed. No acids or prepared cleaners shall be used without the approval of the cast stone manufacturer.

3.7 POINTING

A. When ready for tuck pointing, the mortar joints shall be dampened and raked back 3/4" for pointing. Pointing shall form a slight concave profile. No pointing shall be done in freezing weather nor in locations exposed to hot sun unless properly protected. Pointing mortar shall be composed of one (1) part non-staining cement (ASTM C 91), one (1) part hydrate lime (ASTM C 207, Type S) and four (4) parts of

clean, washed sand (ASTM C 144). Coloring pigments shall be added as specified in Section 042000 for face brick construction. The Architect shall approve color of pointing mortar before proceeding with pointing.

3.8 PROTECTION

A. All projecting cast stone pieces shall be fully protected when installed against damage of any kind. Any piece damaged shall be replaced at no additional cost.

3.9 INSPECTION AND ADJUSTMENT

A. Upon completion of the work, make a thorough inspection of all installed cast stone and verify that all units and joints have been installed in accordance with the provisions of this Section; make all necessary adjustments.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections and type of steel required.

B. Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" as modified here and as otherwise shown on drawings.

1. Section 2.1 to include “Lintels shown or otherwise enumerated or scheduled.”
2. Section 4.4, The first two sentences of this section are to be replaced with the following, “Shop drawings are to be made by the fabricator, prints thereof are to be submitted to the structural engineer and architect for their examination and approval. The fabricator is to include an allowance of fourteen (14) calendar days in his schedule for the review of these drawings by the structural engineer for the return of shop drawings. These calendar days start from the time the drawings are received by the engineer.”

C. Miscellaneous Metal Fabricators are specified elsewhere in Division 5.

D. Refer to Division 3 for anchor bolt installation in concrete; Division 4 for masonry.

E. Source Quality Control: Materials and fabrication procedures are subject to inspection and tests in mill, shop and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

1. Promptly remove and replace materials or fabricated components which do not comply.

F. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

1. Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

1.2 SUBMITTALS

A. Product Data: Submit producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.

2. High-strength bolts (each type), including nuts and washers.
3. Structural steel primer paint.

B. Shop Drawings: Submit shop drawings, including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.

C. Include details of cuts, connections, camber, holes and other pertinent data. Indicate welds by standard AWS A2.1 and A2.4 symbols; and show size, length and type of each weld.

1. Provide setting drawings, templates and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.

D. Test Reports: Submit copies of tests conducted on shop and field bolted and welded connections. Include data on type (s) of tests conducted and test results.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated:

B. AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.

C. AISC "Specifications for Architecturally Exposed Structural Steel".

D. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

E. American Welding Society (AWS) D1.1 "Structural Welding Code - Steel".

F. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

G. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.

1. If recertification of welders is required, retesting will be Contractor's responsibility.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

B. Structural Steel Wide Flange Shapes: ASTM A 992/A572, Grade 50

C. Other Structural Steel Shapes, Plates and Bars: ASTM A 36.

D. Cold-Formed Steel Tubing: ASTM A 500, Grade B.

E. Anchor Bolts: ASTM F 1554, Grade 36, nonheaded type unless otherwise indicated.

F. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts and hardened washers, as follows:

1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A 325.
2. Direct tension indicator washers may be used at Contractor's option.

G. Electrodes for Welding: Comply with AWS Code.

H. Structural Steel Primer Paint: SSPC-PS Guide 7.00

2.2 FABRICATION

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to the greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.

B. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

C. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs and other defects.

D. Connections: Weld or bolt shop connections, as indicated.

E. Bolt field connections, except where welded connections or other connections are indicated.

1. Provide high-strength threaded fasteners for all bolted connections, except where

unfinished bolts are indicated.

F. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" (RCRBSJ).

G. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds and methods used in correcting welding work.

H. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.

I. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.

J. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

K. Field drill holes in existing steel members for connection of new steel as noted on the drawings.

2.3 SHOP PAINTING

A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar or to receive fireproofing. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.

B. Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:

1. SP-1 "Solvent Cleaning".
2. SP-3 "Power Tool Cleaning".

C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with Manufacturer's instructions and at a rate to provide dry film thickness of not less than 1.5 mils. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces.

PART 3 - EXECUTION

3. 1 ERECTION

A. Surveys: Employ a registered professional engineer or land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made, or until compensating adjustment to structural steel work have been agreed upon with Architect.

B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

C. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

D. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

E. Level and plumb individual members of structure within specified AISC tolerances.

F. Splice members only where indicated and accepted on shop drawings.

G. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.

H. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment and removal of paint on surfaces adjacent to field welds.

I. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

J. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only as acceptable to Architect.

K. Touch-Up Painting: Immediately after erection,,clean field welds, bolted connections and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

L. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3. 2 QUALITY CONTROL

A. Owner to engage an independent testing and inspection agency to inspect high strength bolted connections and welded connections and to perform tests and prepare test reports.

B. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements and specifically state any deviations therefrom.

C. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

D. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specified requirements.

E. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any noncompliance of original work, and as may be necessary to show compliance of corrected work.

F. Shop Bolted Connections: Inspect or test in accordance with AISC specifications.

G. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Perform visual inspection of all welds.

H. Field Bolted Connections: Inspect in accordance with AISC specifications.

I. Field Welding: Inspect and test during erection of structural steel as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Perform visual inspection of all welds.

J. Testing agency shall confirm that the structure is square, plumb and level in accordance with AISC tolerances.

K. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency’s option.

1. Liquid Penetration Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level “2-2T.”
4. Ultrasonic Inspection: ASTM E 164.

END OF SECTION 051200

SECTION 054000

COLD FORMED METAL FRAMING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the cold formed metal framing as indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. "C" shaped steel studs for exterior non-load bearing wall frame construction.
2. "C" shaped steel joists.
3. Anchors and accessories.
4. Gypsum sheathing.
5. Field inspection.

1.3 RELATED SECTIONS

A. Masonry - Section 042000.

B. Structural steel - Section 051200.

C. Thermal insulation - Section 072100.

D. Vapor permeable air barrier - Section 072700.

E. Interior steel stud construction - Section 092900.

1.4 QUALITY ASSURANCE

A. Component Design: Compute structural properties of studs in accordance with AISI "North American Specification for the Design of Cold Formed Steel Structural Members."

B. Fire-Rated Assemblies: Where framing units are indicated to be components of fire-resistance rated assemblies, provide cold formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction. Products used in the assembly shall carry a classification label from an approved testing and inspection agency.

C. Qualifications

1. Manufacturer's Qualifications: Minimum five years' experience in producing products of the type specified.
2. Installer's Qualifications: Minimum three years' experience in installation of the type

of product specified.

3. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M "Structural Welding Code - Steel" and AWS DL3 "Structural Welding Code – Sheet Steel."

D. Pre-Installation Meeting

1. Convene meeting at project site within one week of scheduled start of installation with representatives of the following in attendance: Owner, Architect, General Contractor, and metal framing subcontractor.

2. Review substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.

3. Keep minutes of meeting, including responsibilities of various parties and deviations from specifications and installation instructions. Distribute minutes to attendees within 72 hours.

E. Comply with the following standards:

1. American Iron an Steel Institute (AISI):

a. "North American Specification for the Design of Cold-Formed Steel Structural Members," latest edition.
b. "Standard for Cold-Formed Steel Framing General Provisions."

2. American Welding Society (AWS):

a. Structural Welding Code (D1.1).
b. Specifications for Welding Sheet Steel in Structures (E1.3).

3. ASTM:

a. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coted (Galvannealed) by the Hot-Dip Process.
b. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
c. ASTM A 924 - Standard Requirements for Sheet Steel, Metallic-Coated by the Hot-Dipped Process.
d. ASTM C 955 – Standard Specification for Cold-Formed Structural Framing Members.
e. ASTM A 1003 - Standard Specification for Steel Sheet, Carbon, Metallic- and Non-Metallic-Coated for Cold-Formed Framing Members.
f. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
g. ASTM C 1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

F. Vertical and Lateral Fire Propagation Test Characteristics: The exterior wall assembly is required to comply with NFPA 285 “Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components.” The base wall, stud cavity insulation, wall sheathing, air barrier, continuous wall rigid insulation and exterior cladding are components that are required to be to be evaluated as part of this specific assembly test. The basis of design product listed below is a component of the design test assembly selected by the Architect.

1.5 SUBMITTALS

A. Product Data: For information only, submit copies of manufacturer's product information and installation instructions for each item of cold-formed framing and accessories.

B. Shop Drawings

1. Submit shop drawings for special components and installations not fully dimensioned or detailed in manufacturer's product data. Include placing drawings for framing members showing size and gauge designations, number, type, location and spacing. Indicate supplemental bracing, splices, window and door headers accessories and details as may be required for proper installation.

2. If the Contractor elects to prefabricate framing members into panels for erection, he shall submit shop drawings of such panels at suitable scale showing all dimensions, components, and methods of fastening and support.

C. For fasteners, submit product data sheet and samples.

D. Engineering Data

1. Submit Engineering Data drawings to the Architect for review. The Contractor is responsible for the structural design and supports for the cold-formed metal frame, and must show his proposed system and how the Performance Criteria noted below is accommodated on these drawings.

2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of members. Calculations and drawings must be prepared by a Structural Engineer licensed in the State of new Jersey and shall be signed and sealed by this Engineer.

E. Quality Assurance Submittals: Submit the following:

1. Qualifications: Proof of manufacturer and installer qualifications.

a. Member in good standing of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance.

b. Products to be certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.

2. Structural design calculations.

3. Certificates

a. Submit mill certificates by framing member/accessory manufacturer certifying compliance with material requirements.
b. Welder certificates.

4. Manufacturer's installation instructions for framing members and framing accessories.

1.6 PERFORMANCE CRITERIA

A. Cold-formed metal framing system shall be designed, fabricated, and installed to

withstand a 30 psf suction and pressure load (or greater if required by Code) with a maximum deflection of L/720 with brick.

1. For insulated metal panels, provide minimum 16 gauge studs, unless greater required by performance requirements above. (SPEC WRITER NOTE DELETE IF NO INSULATED PANELS)

B. Cold Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100 and AISI S200 and ASTM C955, Section 8.

C. Design system to accommodate vertical deflection of structural building frame, live loading, seasonal and day/night temperature ranges and construction tolerances.

D. Comply with prevailing Code requirements for seismic connections and loads.

1.7 PRODUCT DELIVERY AND STORAGE

A. Protect metal framing units from rusting and damage. Deliver to one project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off the ground in a dry ventilated space or protect with suitable waterproof coverings. Conform to storage and handling requirements of AISI "Code of Standard Practice."

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Provide cold-formed steel framing manufactured by Marino/Ware, Superior Steel Studs, Clark Dietrich Building Systems, Super Stud Building Products, or approved equal.

2.2 METAL FRAMING: GENERAL

A. System Components: With each type of metal framing required, provide manufacturer's standard steel runners, (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners and accessories, as recommended by manufacturer for the applications indicated, as needed to provide a complete metal framing system.

2.3 MATERIALS

A. Steel Sheet for Studs and Tracks: ASTM A 1003 Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.

2. Coating: G90 galvanized coating.

B. Steel Sheet for Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.

2. Coating G90 galvanized coating.

2.4 FRAMING MEMBERS

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges; thickness and grade as required by structural performance.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths compatible with studs, un-punched, with un-stiffened flanges; thickness and grade as required by structural performance.

2.5 FRAMING ACCESSORIES

A. Stamp manufacturer's name on each accessory item.

B. Provide screws with accessories designated for screw attachment.

C. Connector Devices

1. Vertical Deflection Clips: "VertiClip," including step bushings, as manufactured by The Steel Network Inc. (919) 845-1025 or approved equal. Rigid attachments to structure and screw attachment to stud web using step-bushings to permit frictionless vertical movement. 68 mils minimum thickness, size as required by structural design calculations.

2. Rigid Clip Angles: "StiffClip" as manufactured by The Steel Network Inc., or approved equal, size as required by structural design calculations. Rigid attachment to structure and stud web.

D. Bridging

a. Cold Rolled Channel: 1-1/2" by ½" by 56 mil thick.Bridging Clip: "BridgeClip" as manufactured by The Steel NetworkInc. or approved equal. Provide attachment through stud punch-out clamping onto stud web and wrapping around bridging channel. Provide holes for screw attachment to stud web and channel.

2. Flat Strap: Width and thickness as required by structural design calculations. Rigid attachment to stud flange.

3. Solid Bridging: Channel shaped bridging with lipped flanges and integral formed clips. Screw attachment to stud. 33 mils minimum thickness, size as required by structural design calculations.

4. Bridging and accessories shall be hot dip zinc coated per ASTM A 153.

E. Header for Window and Door Openings: Provide "ProX Header" system made by Brady Innovations LLC, or approved equal, complete with all accessories including clips and accessories; finish and gauge to match studs.

2.6 FASTENERS

A. Screws: Corrosion resistant coated, self-drilling, pan or hex washer head. Provide screw type and size as required by structural design calculations.

B. Anchor Bolts and Studs: ASTM A 307, Grade A, carbon steel, with hex-head carbon steel nuts and flat steel washers. Hot-dip zinc coated in accordance with ASTM A 153. Provide bolt or stud type and size as required by structural design calculations.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

2.7 GALVANIZING TOUCH-UP

A. For touching up damaged galvanized surfaces after erection, provide "Silver Galv" made by Z.R.C. Worldwide, or approved equal.. Apply to a dry film thickness of 1.5 to 3.0 mils.

2.8 GYPSUM SHEATHING AND RELATED ACCESSORIES

A. Gypsum Sheathing: 5/8" thick "Dens-Glass Fireguard," Type X, made by Georgia Pacific, "Securock Glass-Mat Sheathing" made by U.S. Gypsum Co., "Gold Bond EXP Extended Exposure Sheathing" made by National Gypsum Co., "Weather Defense" made by Lafarge/Continental, or approved equal, meeting ASTM C 1177, Type X.

B. Fasteners: 1-1/4" Type S-12 screws "Climaseal" finish.

C. Joint Treatment: Provide a one-part high performance sealant conforming to ASTM C 920, Type S, Grade NS, Class 25 meeting with the approval of the air/vapor barrier manufacturer for compatibility; see Section 072700 for description. Apply a 3/8" bead of sealant to the joint and trowel flat. Apply enough of the same material to each fastener to cover completely when trowelled flat.

2.9 FABRICATION

A. Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion in any members in the assembly.

B. Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting or screw fasteners, as standard with manufacturer.

C. Wire tying of framing components is not permitted.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where cold-formed metal framing is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION: GENERAL

A. Methods of construction shall be piece by piece.

B. Connections shall be accomplished with self-drilling screws or welding so that the connection meets or exceeds the design loads required at that connection.

C. Studs shall be installed seated squarely (within 1/16") against the web portion of the top and bottom tracks. Tracks shall rest on a continuous, uniform bearing surface.

D. Cutting of steel framing members may be accomplished with a saw or shear. Torch cutting of loaded members is not permitted. Cutting of loaded members is not permitted unless under supervision of the project architect or engineer.

E. Temporary bracing shall be provided and left in place until work is permanently stabilized.

F. Bridging shall be of size and type shown on the approved shop drawings and as called for in the engineering calculations.

G. Install headers in all openings that are larger than the stud spacing in that wall. Form headers as shown on the drawings.

H. Insulation meeting the requirements of Section 072100 shall be placed in all jamb and header type conditions that will be inaccessible after their installation into the wall.

I. Provide jack studs to support each end of headers. These studs shall be securely connected to the header and must seat squarely in the lower track of the wall, and be properly attached to it.

J. If, by design, a header is low in the wall, the less than full-height studs (cripples) that occur over the header shall be designed to carry all imposed loads.

K. Wall track shall not be used support any load unless specifically designed for that purpose.

L. All axially loaded members shall be aligned vertically, to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections or alternate provisions for load transfer may be made.

M. Holes that are field cut into steel framing members shall be within the limitation of the product and its design. Provide reinforcement where holes are cut through load bearing members in accordance with manufacturer's recommendations and as approved by the Architect or Engineer.

N. Touch up all steel bared by welding using touch-up coating specified herein.

O. Studs shall be spaced to suit the design requirements and limitations of collateral facing materials.

P. Care should be taken to allow for additional studs at intersections, corners, doors, windows, control joints, etc., and as called for in the shop drawings or design calculations.

Q. Install supplementary framing, blocking, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer’s recommendations and industry standards in each case, considering weight or loading resulting from item supported.

R. Provide for structure movement, expansion shall be allowed where indicated and

necessary by design or code requirements.

S. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with components of stud system.

T. Install horizontal bridging in stud system, spaced (vertical distance) at not more than 48 inches on center. Fasten at each intersection.

U. Splicing of axially loaded members or floor joists shall not be permitted.

V. Wire tying of members is not permitted.

3.3 INSTALLATION OF GYPSUM SHEATHING

A. Fasten sheathing to exterior of each stud with specified fasteners spaced 3/8" from ends and edges and approx. 8" o.c. at each stud. Install fasteners in accordance with manufacturer's recommendations using 2500-RPM maximum screw gun. Sheathing board shall be installed horizontally. Apply sealant between joints and trowel flush; and apply sealant around sheathing perimeter and at interface with other materials. Cover fastener heads with sealant and trowel flush.

B. Refer to Section 072700 for vapor permeable air barrier description.

END OF SECTION

SECTION 055000

MISCELLANEOUS METALS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the miscellaneous metal work as indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. Rough hardware.
2. Vertical steel ladders.
3. Vertical aluminum ladder.
4. Loose steel lintels.
5. Steel pipe handrails and railings.
6. Light steel framing and supports not included as part of work of other trades.
7. Miscellaneous steel trim, corner guards, angle guards and channels.
8. Countertop supports.
9. Steel framing, bracing, supports, anchors, bolts, shims, fastenings, and all other supplementary parts indicated on drawings or as required to complete each item of work of this Section.
10. Prime painting, touch-up painting, galvanizing and separation of dissimilar metals for work of this Section.
11. Cutting, fitting, drilling and tapping work of this Section to accommodate work of other Sections and of concrete, masonry or other materials as required for attaching and installing work of this Section.

1.3 RELATED SECTIONS

A. Structural steel - Section 051200.

B. Painting - Section 099000.

1.4 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

C. Reference Standards: The work is subject to requirements of applicable portions of the following standards:

1. "Manual of Steel Construction," American Institute of Steel Construction.

2. AWS D1-1 "Structural Welding Code," American Welding Society.

3. SSPC SP-3 "Surface Preparation Specification No. 3, Power Tool Cleaning," Steel Structures Painting Council.

4. SSPC PA-1 "Painting Application Specification," Steel Structures Painting Council.

5. "Handbook on Bolt, Nut and Rivet Standards," Industrial Fasteners Institute.

D. Steel Materials: For steel to be hot dip-galvanized, provide steel chemically suitable for metal coatings complying with the following requirements: carbon below 0.25 percent, silicon below 0.24 percent, phosphorous below 0.05 percent, and manganese below 1.35 percent. Notify galvanizer if steel does not comply with these requirements to determine suitability for processing.

E. Engage the services of a galvanizer who has demonstrated a minimum of five (5) years' experience in the successful performance of the processes outlined in this specification in the facility where the work is to be done and who will apply the galvanizing and coatings within the same facility as outlined herein. The Architect has the right to inspect and approve or reject the galvanizer/galvanizing facility.

F. The galvanizer/galvanizing facility must have an ongoing Quality Control/Quality Assurance program which has been in effect for a minimum of five years and shall provide the Architect with process and final inspection documentation. The galvanizer/galvanizing facility must have an on-premise testing facility capable of measuring the chemical and metallurgical composition of the galvanizing bath and pickling tanks.

G. Inspection and testing of hot-dip galvanized coating shall be done under the guidelines provided in the American Hot-Dip Galvanizers Association (AGA) publication "Inspection of Products Hot-Dip Galvanized After Fabrication."

1.5

1.6 PERFORMANCE STANDARDS

A. Railings shall be constructed to conform to the following performance standards:

1. Railings shall be designed to resist loads per State of New Jersey Building Code.

1.7 SUBMITTALS

A. Manufacturer's Literature: Submit manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions for products to be used in the fabrication of miscellaneous metal work, including paint products.

B. Shop Drawings: Shop drawings for the fabrication and erection of all assemblies of miscellaneous iron work which are not completely shown by manufacturer's data sheets. Include plans and elevations at not less than 1" to 1'-0" scale and include details of sections and connections at not less than 3" to 1'-0" scale. Show anchorage and accessory items.

C. Engineering Data

1. Before any ladders or railings are fabricated, submit engineering data drawings to the Architect for review indicating how performance standards specified here shall be met. The Contractor is responsible for the structural design and supports for these systems and must show his proposed systems on these drawings.

2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of members. Calculations and drawings must be prepared by a Structural Engineer licensed in the State of New Jersey and shall be signed and sealed by this Engineer.

D. Welding shall be indicated on shop drawings using AWS symbols and showing length, size and spacing (if not continuous). Auxiliary views shall be shown to clarify all welding. Notes such as 1/4" weld, weld and tack weld are not acceptable.

E. Certification: For items to be hot-dip galvanized, identify each item galvanized and to show compliance of application. The Certificate shall be signed by the galvanizer and shall contain a detailed description of the material processed and the ASTM standard used for the coating and, the weight of the coating. In addition, and as attachment to Certification, submit reports of testing and inspections indicating compliance with the provisions of this Section.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metals

1. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

2. Steel Plates, Shapes and Bars: ASTM A 36.

3. Steel Bar Grating: ASTM A 1011 or ASTM A 36.

4. Steel Tubing: Cold formed, ASTM A 500; or hot rolled, ASTM A 501.

5. Structural Steel Sheet: Hot rolled, ASTM A 1011; or cold rolled, ASTM A 1008, Class 1; of grade required for design loading.

6. Galvanized Structural Steel Sheet: ASTM A 924, of grade required for design loading. Coating designation G90.

7. Steel Pipe: ASTM A 53, type and grade as selected by fabricator and as required for design loading; black finish unless galvanizing is indicated; standard weight (Schedule 40), unless otherwise indicated.

8. Gray Iron Castings: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.

9. Malleable Iron Castings: ASTM A 47, grade as selected by fabricator.

10. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

11. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A 153.

B. Grout: Non-shrink, non-metallic grout conforming to the requirements of Section 033000.

C. Fasteners

1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.

2. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

3. Anchor Bolts: ASTM F 1554, Grade 36.

4. Lag Bolts: ASME B18.2.1.

5. Machine Screws: ASME B18.6.3.S

6. Plain Washers: Round, carbon steel, ASME B18.22.1.

7. Masonry Anchorage Devices: Expansion shields, FS FF-S-325.

8. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required.

9. Lock Washers: Helical spring type carbon steel, ASME B18.21.1.

D. Shop Paint: Shop primer for all non-galvanized miscellaneous metal items.

1. Basis of Design: Tnemec; Series 88 Azeron Primer, or approved equal.

2. If steel is to receive high performance coating as noted in Section 099000, shop prime using primer noted in Section 099000.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Galvanizing Repair Coating: For touching up galvanized surfaces after erection, provide repair coating that is V.O.C. compliant. Apply to a dry film thickness of 1.5 to 3.0 mils.

1. Basis of Design: Z.R.C. Worldwide; Silver Galv

2.2 PRIME PAINTING

A. Scope: All ferrous metal (except galvanized steel) shall be cleaned and shop painted with one coat of specified ferrous metal primer. No shop prime paint required on galvanized steel or aluminum work.

B. Cleaning: Conform to Steel Structures Painting Council Surface Preparation Specification SP 3 (latest edition) "Power Tool Cleaning" for cleaning of ferrous metals which are to receive shop prime coat.

1. Steel to get high performance coating as noted in Section 099000 shall be cleaned as per SSPC SP.6 "Commercial Blast Cleaning."

C. Application

1. Apply shop prime coat immediately after cleaning metal. Apply paint in dry weather or under cover. Metal surfaces shall be free from frost or moisture when painted. Paint all metal surfaces including edges, joints, holes, corners, etc.

2. Paint surfaces which will be concealed after shop assembly prior to such assembly. Apply paint in accordance with approved paint manufacturer's printedinstructions, and the use of any thinners, adulterants or admixtures shall be only as stated in said instructions.

3. Paint shall uniformly and completely cover the metal surfaces, 2.0 mils minimum dry film thickness. No work shall be shipped until the shop prime coat thereon has dried.

D. Touch-Up: In the shop, after assembly and in the field, after installation of work of this Section, touch-up damaged or abraded portions of shop prime paint with specified ferrous metal primer.

E. Apply one shop coat to fabricated metal items, except apply two (2) coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

2.3 GALVANIZING

A. Scope: All ferrous metal exposed to the weather, and all ferrous metals indicated on drawings or in specifications to be galvanized, shall be cleaned and then hot-dipped galvanized after fabrication.

1. Basis of Design: Duncan Galvanizing.

B. Avoid fabrication techniques that could cause distortion or embrittlement of steel items to be hot-dip galvanized. Fabricator shall consult with hot-dip galvanizer regarding potential warpage problems or handling problems during the galvanizing process that may require adjustment of fabrication techniques or design before finalizing shop drawings and beginning of fabrication.

C. Cleaning: Thoroughly clean metal surfaces of all mill scale, rust, dirt, grease, oil, moisture and other contaminants prior to galvanizing.

D. Application: Hot-dip galvanizing shall conform to the following:

1. ASTM A 143: Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel.

2. ASTM A 123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A 153: Galvanized Coating on Iron and Steel Hardware - Table 1.

4. ASTM A 384: Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.

5. ASTM A 385: Practice for Providing High Quality Zinc Coatings.

6. ASTM A 924: Galvanized Coating on Steel Sheets.

7. Minimum weight of galvanized coating shall be two (2) oz. per square foot of surface.

E. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

F. All galvanized materials must be inspected for compliance with these specifications and

marked with a stamp indicating the name of the galvanizer, the weight of the coating, and the appropriate ASTM number.

G. To minimize surface imperfection (e.g.: flux inclusions), material to be galvanized shall be dipped into a solution of Zinc Ammonium Chloride (pre-flux) immediately prior to galvanizing. The type of galvanizing process utilizing a flux blanket overlaying the molten zinc will not be permitted.

H. After galvanizing all materials not exposed to view must be chromated by dipping material in a 0.2% chromic acid solution.

I. Galvanized surfaces, where exposed to view, must have a smooth, level surface finish. Where this does not occur, piece shall be rejected and replaced to the acceptance of the Architect.

2.4 PROTECTIVE COATINGS

A. Whenever dissimilar metals will be in contact, separate contact surfaces by coating each contact surface prior to assembly or installation with one coat of specified bituminous paint, which shall be in addition to the specified shop prime paint. Mask off those surfaces not required to receive protective coating.

2.5 WORKMANSHIP

A. General

1. Miscellaneous metal work shall be fabricated by an experienced fabricator or manufacturer and installed by an experienced tradesman.

2. Materials, methods of fabrication, fitting, assembly, bracing, supporting, fastening, operating devices, and erection shall be in accordance with drawings and specifications, approved shop drawings, and best practices of the industry, using new and clean materials as specified, having structural properties sufficient to safely sustain or withstand stresses and strains to which materials and assembled work will be subjected.

3. All work shall be accurately and neatly fabricated, assembled and erected.

B. Shop Assembly: Insofar as practicable, fitting and assembly of work shall be done in shop. Shop assemble work in largest practical sizes to minimize field work. It is the responsibility of the miscellaneous metal subcontractor to assure himself that the shop-fabricated miscellaneous metal items will properly fit the field condition. In the event that shop-fabricated miscellaneous metal items do not fit the field condition, the item shall be returned to the shop for correction.

C. Cutting: Cut metal by sawing, shearing, or blanking. Flame cutting will be permitted only if cut edges are ground back to clean, smooth edges. Make cuts accurate, clean, sharp and free of burrs, without deforming adjacent surfaces or metals.

D. Holes: Drill or cleanly punch holes; do not burn.

E. Connections: Make connections with tight joints, capable of developing full strength of member, flush unless indicated otherwise, formed to exclude water where exposed to weather. Locate joints where least conspicuous. Unless indicated otherwise, weld or bolt shop connections; bolt or screw field connections. Provide expansion and contraction joints to allow for thermal movement of metal at locations and by methods approved by Architect.

1. Welding

a. Shall be in accordance with AWS D1.1 Structural Welding Code of the American Welding Society and shall be done with electrodes and/or methods recommended by the manufacturer of the metals being welded.
b. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth with and to match finish of adjoining surfaces; undercut metal edges where welds are required to be flush.
c. All welds on or behind surfaces which will be exposed to view shall be done so as to prevent distortion of finished surface. Remove weld spatter and welding oxides from all welded surfaces.

2. Bolts and Screws: Make threaded connections tight with threads entirely concealed. Use lock nuts. Bolts and screw heads exposed to view shall be flat and countersunk. Cut off projecting ends of exposed bolts and screws flush with nuts or adjacent metal.

F. Operating Mechanism: Operating devices (i.e. pivots, hinges, etc.) mechanism and hardware used in connection with this work shall be fabricated, assembled, installed and adjusted after installation so that they will operate smoothly, freely, noiselessly and without excessive friction.

G. Built-In Work: Furnish anchor bolts, inserts, plates and any other anchorage devices, and all other items specified under this Section of the Specifications to be built into concrete, masonry or work of other trades, with necessary templates and instructions, and in ample time to facilitate proper placing and installation.

H. Supplementary Parts: Provide as necessary to complete each item of work, even though such supplementary parts are not shown or specified

I. Coordination: Accurately cut, fit, drill and tap work of this Section to accommodate and fit work of other trades. Furnish or obtain, as applicable, templates and drawings to or from applicable trades for proper coordination of this work.

J. Exposed Work

1. In addition to requirements specified herein and shown on drawings, all surfaces exposed to view shall be clean and free from dirt, stains, grease, scratches, distortions, waves, dents, buckles, tool marks, burrs, and other defects which mar appearance of finished work.

2. Metal work exposed to view shall be straight and true to line or curve, smooth arrises and angles as sharp as practicable, miters formed in true alignment, profiles accurately intersecting, and with joints carefully matched to produce continuity of line and design.

3. Exposed fastenings, where permitted, shall be of the same material, color and finish as the metal to which applied, unless otherwise indicated, and shall be of the smallest practicable size.

K. Preparation for Hot-Dip Galvanizing: Fabricator shall correctly prepare assemblies for galvanizing in consultation with galvanizer and in accordance with applicable Reference Standards and applicable AGA publications for the "Design of Products to be Hot-Dip galvanized After Fabrication." Preparation shall include but not be limited to the following:

1. Remove welding flux.

2. Drill appropriate vent holes and provide for drainage in inconspicuous locations of hollow sections and semi-enclosed elements. After galvanizing, plug vent holes with shaped lead and grind smooth.

2.6 MISCELLANEOUS METALS ITEMS

A. Rough Hardware

1. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.

2. Fabricate items to sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood connections; elsewhere, furnish steel washers.

B. Ladder

1. Vertical steel ladders shall be eighteen (18) inches wide with 3/4" diameter non-slip steel rungs spaced twelve (12) inches o.c. Stringers shall be 3/8" thick by 2-1/2" wide steel bars; rungs welded to bars. Attach ladders to walls six (6) inches from top and bottom and maximum thirty-six (36) inches o.c. from these points. At the roof, gooseneck the rails back to the structure to provide secure ladder access.

2. Aluminum Ladder: Heavy Duty Tubular rail model 501 by O'Keeffe's Inc with rail and harness fall arrest system, in Class I Clear anodized finish.

3. Ladders shall be fabricated to support a live load of one hundred (100) lbs. per square foot and a concentrated load of three hundred (300) lbs. per rung; loads not to act simultaneously.

C. Steel Pipe Handrails

1. Steel pipe of size shown on Drawings, Schedule 40. Fittings shall be flush type, malleable of cast iron. Brackets shall be malleable iron, design as selected by the Architect.

2. Construction: Form direction changes in rails using solid bar stock or elbows. Connections shall be shop welded and ground smooth and flush, except where field connections and expansion joints are required. Field connections may be welded, internal sleeve and plug weld, or internal sleeve and set screw.

3. Secure handrails to walls with wall brackets. Provide brackets of malleable iron castings, with not more than three (3) inches clearance from inside face of handrail to wall surface. Neatly drill wall plate portion of the bracket into concrete or masonry to receive bolts for concealed anchorage. For installation at drywall, Drywall trades shall provide plate to receive wall plate portion of bracket and anchor or bolt wall plate through drywall to supporting steel plate. Locate brackets at not more than 5'-0" o.c. unless otherwise shown.

4. Provide wall return fittings of cast iron, flush type, with the same projection as that specified for wall brackets.

5. Longitudinal members shall be parallel with each other and with floor surface or shape of stair to a tolerance of 1/8" in 10'-0" linear feet. Center line of members within each run of railing shall be in the plane.

6. For steel pipe posts where indicated, anchor posts in concrete by means of pipe sleeves set and anchored into concrete. Provide sleeves of galvanized steel pipe, not less than six (6) inches long and having an inside diameter not less than 1/2" greater than outside diameter of the inserted pipe. Provide steel plate closure secure to bottom of sleeve and of width and length not less than one (1) inch greater than outside diameter of sleeve. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with non-shrink, non-
ferrous grout. Cover anchorage joint with a round steel flange welded to post.

Posts shall be set plumb within 1/8" vertical tolerance.

7. Steel pipe handrails shall be capable of resisting a two hundred (200) lb. force applied to rail from any direction and a uniformly distributed load of fifty (50) lbs. per linear foot applied downward or horizontally, loads not to act simultaneously.

D. Miscellaneous Light Steel Framing

1. Light steel framing, bracing, supports, framing, clip angles, shelf angles, plates, etc., shall be of such shapes and sizes as indicated on the drawings and details or as required to suit the condition and shall be provided with all necessary supports and reinforcing such as hangers, braces, struts, clip angles, anchors, bolts, nuts, welds, etc., as required to properly support and rigidly fasten and anchor same in place and to steel, concrete, masonry and all other connecting and adjoining work.

2. All light steel framing steel shall be furnished and erected in accordance with the applicable requirements of the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" by the American Institute of Steel Construction and as specified herein.

E. Miscellaneous Steel Trim: Provide shapes and sizes for profiles shown. Except as otherwise indicated, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other work.

F. Countertop Supports: Steel framing as indicated or required to support countertops. Conceal framing under countertops and within wall behind countertops. Provide supports to withstand a concentrated load of not less than three hundred (300) lbs. applied at any point with a deflection not to exceed L/240 for the length of the countertop.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where miscellaneous metal is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 ERECTION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction;

including threaded fasteners for concrete and masonry inserts, toggle bolts, through-

bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry, or similar construction.

C. Fitting Connections: Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot dip galvanized after fabrication, and are intended for bolted or screwed field connections.

D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance, and quality of welds made, and methods used in correcting welding work.

E. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

F. Field Touch-Up of Galvanized Surfaces: Touch-up shop applied galvanized coatings damaged during handling and installation. Use galvanizing repair coating specified herein for galvanized surfaces.

END OF SECTION

SECTION 055200

ALUMINUM HANDRAILS AND RAILINGS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the interior and exterior ornamental handrails and railings as shown on the drawings and/or specified herein.

1. Aluminum guardrails and railings.

1.3 RELATED SECTIONS

A. Concrete work - Section 033000.

B. Masonry construction- Section 042000.

1.4 QUALITY ASSURANCE

A. General: Work of this section shall be fabricated and installed by an experienced fabricator or manufacturer who has been engaged in work of equivalent scope and fabrication standards for at least 5 years. Materials, methods of fabrication, fitting, assembly, bracing, supporting, fastening, operating devices and erection shall be in accordance with drawings, specifications, and approved shop drawings, and be of highest quality practices of the industry, using new and clean materials as specified, having structural properties sufficient to safely sustain or withstand stresses and strains to which materials and assembled work will be subjected. All work shall be accurately and neatly fabricated, assembled, and erected.

B. Single-Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.

C. Engineer Qualifications: Professional engineer legally authorized to practice in the State of New Jersey and experienced in providing engineering services of the kind indicated for handrails and railing systems similar to this Project in material, design, and extent, and that have a record of successful in-service performance.

1.5 SUBMITTALS

A. Shop Drawings: Submit for all items of work, at full scale as far as practical, showing metal thicknesses, arrangement of components, of joining, of jointing, details of all field connections and anchorages, diagrams and details explaining provisions for thermal

movement, fastening and sealing methods, and support methods, metal finishes and all other pertinent information.

1. Engineering design and calculations for handrails and railing assemblies - see Article 1.7 herein.

B. Samples for Verification: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the work.

1. 6” (150 mm) long sections of each different linear railing member, including handrails, top rails, posts, and balusters.

2. Fittings and brackets.

3. Welded connections.

4. Assembled samples of railings, made from full size components, including top rail, post and handrail. Show method of finishing members at intersections. Samples need not be full height.

1.6 PRODUCT HANDLING

A. Finished Materials: Protect finishes against soiling, staining or damage from scratches and abrasion. Maintain protection during construction until project completion or as otherwise directed by Architect.

1. Provide wrappings, strippable coatings or other means approved by Architect.

2. During construction, remove protection for visual observation of finish as directed by Architect and replace to maintain protection.

1.7 PERFORMANCE STANDARDS (UNLESS GREATER REQUIED BY CODE)

A. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to withstand the structural loads indicated in the State of New Jersey Building Code, without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each of the respective components of each metal fabrication. Provide stamped and sealed drawings by Professional Engineer licensed in the State of New Jersey

B. Structural Performance of Guard Rail Systems (unless greater required by Code): Engineer, fabricate, and install railing guards to withstand the following structural loads, as indicated in the State of New Jersey Building Code without exceeding the allowable design working stress of the guard assembly materials, anchors and connections.

1. Infill of Guards:

a. Concentrated load of 200 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating, and installing handrails and railing systems to prevent buckling, opening of joints, overstressing of

components and connections, damage to adjoining construction, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 120 deg F ambient, 180 deg F material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide materials which have been selected for their surface flatness, smoothness and freedom from surface blemishes where exposed to view in the finished unit. Surfaces exposed to view that exhibit pitting, seam marks, roller marks, "oil-canning," stains, discoloration's or other imperfections on the finished units will not be acceptable.

B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy and temper designated below for each aluminum form required.

1.	Extruded Bar and Tube	ASTM B 221, alloy 6063-T5/T52.
2.	Extruded Structural Pipe and Tube	ASTM B 429, alloy 6063-T6.
3.	Drawn Seamless Tube	ASTM B 210, alloy 6063-T832.
4.	Plate and Sheet	ASTM B 209, alloy 6061-T6.
5.	Die and Hand Forgings	ASTM B 247, alloy 6061-T6.
6.	Castings:	ASTM B 26, alloy A356-T6.

7. Shop prime with rust inhibitive primer equal to Series 88 Azeron made by Tnemec, or approved equal made by Benjamin Moore or Sherwin Williams.

C. Protection for Metals: Bituminous paint; cold applied asphalt mastic complying with SSPC - Part 12, but containing no asbestos fibers.

D. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of the metal to be welded, and as required for color match, strength and compatibility in the fabricated items.

E. Fasteners for Interconnecting Handrails and Railing Components: Furnish of basic metal and alloy, matching finished color and texture as the metal being fastened, unless otherwise indicated. Unless otherwise shown, provide Phillips flat-head screws for exposed fasteners.

F. Fasteners for Anchoring Handrails and Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of.withstanding design loads. Fasteners shall be fabricated from Type 304 or 316 stainless steel.

G. Erosion-Resistant Anchoring Cement: Factory packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at project site to create pourable anchoring, patching, and grouting compound. Provide formulation that

is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.2 FABRICATION

A. General: Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than those required to support structural loads.

B. Assemble handrails and railings in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. . Clearly mark units for reassembly and coordinated installation.

C. Form changes in direction of members as detailed or, if not detailed, by either of the following methods:

1. By radius bends of radius indicated.

2. By flush radius bends.

3. By bending.

4. By insertion of prefabricated flush elbow fittings.

D. Welded Connections: Fabricate steel handrails and railing systems for connection of members by welding, except as otherwise indicated. Limit non-welded connections to connections that cannot be made in the factory due to size or handling limitations and similar considerations. For connections made during fabrication, weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe or tube to which end is joined, and weld all around.

5. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

E. Non-Welded Connections: Fabricate aluminum handrails and railing systems by connecting members with railing manufacturer’s standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using epoxy structural adhesive where this represents manufacturer’s standard splicing method.

F. Brackets, Flanges, Fittings and Anchors: Provide manufacturer’s standard wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing system members to other construction.

G. Provide inserts and other anchorage devices to connect handrails and railing systems to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.

H. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

I. Ease exposed edges to a radius of approximately 1/32", unless otherwise indicated. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.

J. Cut, reinforce, drill and tap components, as indicated, to receive finish hardware, screws, and similar items.

K. Provide weepholes, or another means to evacuate entrapped water, in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.

L. Fabricate joints that will be exposed to weather in a manner to exclude water.

M. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

N. Close exposed ends of pipe by welding 3/16 inch-thick steel plate in place or with prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4 inch or less.

O. Fillers: Provide steel sheet or plate fillers, of thickness and size indicated or required to support structural loads of handrails, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses to produce adequate bearing to prevent bracket rotation and overstressing substrate.

2.3 ALUMINUM FINISH

A. Powder-Coat Finish: AAMA 2605 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for installing anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION - GENERAL

A. Fit exposed connections accurately together to form tight, hairline joints.

B. Cutting, Fitting, and Placement: Perform cutting, drilling and fitting required for installing handrails and railing systems. Set handrails and railing systems accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of handrails and railing components that have been coated or finished after fabrication and are intended for field connection by

mechanical or other means without further cutting or fitting.

2. Set posts plumb within a tolerance of 1/4 inch in 12 feet.

3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

4. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loadings.

5. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing handrails and railing systems and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Non-Welded Connections: Use mechanical joints for permanently connecting railing components in the field. Locate exposed fasteners in least conspicuous locations. Seal recessed holes of exposed locking screws with plastic filler, cement colored to match finish of handrails and railing systems.

1. Welded Connections: Fully welded joints for permanently connecting steel railing components may be used where unavoidable. Cope or butt components to provide 100 percent contact, or use fittings designed for this purpose.

B. Expansion Joints: Install expansion joints at locations indicated but not further apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Attach posts to wall with custom wall brackets as indicated on drawings. Secure wall brackets to building construction as follows:

1. Use type of bracket with predrilled hole for exposed bolt anchorage.

2. For solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.

3. For hollow masonry anchorage, use toggle bolts with square heads.

B. Anchor posts in concrete by forming or core-drilling holes not less than 5 inches deep and 3/4 inch greater than outside diameter of post. Clean holes of all loose material, insert posts, and fill annular space between post and concrete with the following anchoring material, mixed and placed to comply with anchoring material manufacturer’s directions.

1. Non-shrink, non-metallic grout, or, for interior applications only, anchoring cement.

2. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8 inch buildup, sloped away from post.

C. Anchor posts to metal surfaces by direct welding unless otherwise indicated.

3.5 ANCHORING RAIL ENDS

A. Anchor rail ends into concrete and masonry with round flanges connected to rail ends and anchored into wall construction with post installed anchors and bolts.

3.6 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets and end fittings. Provide bracket with 1-1/2 inch clearance from inside face of handrail to finished wall surface.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets and wall return fittings to building construction as follows:

1. Use type of bracket with predrilled hole for exposed bolt anchorage.

2. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.

3. For hollow masonry anchorage, use toggle bolts with square heads.

4. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.

3.7 CLEANING, PROTECTION AND ADJUSTMENT

A. Cleaning and Protection: Protect work from misuse or damage after installation has been completed. Work which is scratched, etched or damaged will not be accepted by Owner, and shall be replaced with acceptable work. Protect work shall against soiling, etching or other contamination. This work shall be done at no additional cost to Owner.

B. Touchup Aluminum Finishes: Immediately after erection, clean bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

C. Protect shop-applied aluminum finishes of handrails and railing systems from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

1. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 062000

CARPENTRY

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the carpentry work as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Blocking and miscellaneous wood, including wall lining for telephone and electric closets.

2. Rough hardware.

3. Coat closet pole and shelving.

4. Installation only of finish hardware.

5. Installation only of doors and hollow metal frames.

1.3 RELATED SECTIONS

A. Architectural woodwork - Section 064023.

B. Steel doors and frames - Section 081113.

C. Wood doors - Section 081416.

D. Finish hardware - Section 087100.

1.4 QUALITY ASSURANCE

A. Lumber Standard: Comply with PS 20.

B. Plywood Standard: Comply with PS 1 and American Plywood Assoc. (APA).

C. Shop fabricate carpentry work to the extent feasible and where shop fabrication will result in better workmanship than feasible for on-site fabrication.

D. Grade Marks: Identify lumber and plywood by official grade mark.

1. Lumber: Grade stamp to contain symbol of grading agency certified by Board of Review, American Lumber Standards Committee, mill number or name, grade of

lumber, species grouping or combination designation, rules under which graded where applicable, and condition of seasoning at time of manufacture.

a. MC-15 or KD: Maximum of fifteen (15) percent moisture content.

E. Installation of doors, frames and hardware shall conform to the minimum standards of "Installation Guides for Doors and Hardware" of the Door and Hardware Institute.

1.5 SUBMITTALS

A. Pressure Treatment: Include certification by treating plant stating chemicals and process used, net amount of salts retained and conformance with applicable standards.

B. Fire-Retardant Treatment: Include certification by treating plant that treatment material complies with governing ordinances and that treatment will not bleed through finished surfaces.

1.6 PRODUCT HANDLING

A. Deliver carpentry materials to the site ready to use with each piece of lumber clearly marked as to grade, type and mill, and place in an area protected from the elements.

B. Deliver rough hardware in sealed kegs and/or other containers which shall bear labels as to type and kind.

C. Pile lumber for rough usage, when delivered to the site in stacks to ensure drainage and with a minimum clearance of six (6) inches above grade. Cover stacks with tarpaulins or other watertight coverings. Store grounds and similar small sized lumber inside the building as soon as possible after delivery.

D. Do not store seasoned lumber in wet or damp portions of the building.

E. Protect fire retardant treated materials against high humidity and moisture during storage and erection.

F. Remove delivered materials which do not conform to specified grading rules or are otherwise not suitable for installation from the job site and replace with acceptable materials.

G. All items specified in Section 087100 of this specification entitled "Finish Hardware" shall be received, accounted for, stored and applied under this Section.

H. Hardware shall be sorted and stored in space assigned by Contractor and shall be kept at all times under lock and key. The safety and preservation of all items delivered will be the responsibility of the Contractor.

1.7 JOB CONDITIONS

A. Installer must examine the substrates and supporting structure and the conditions under which the carpentry work is to be installed, and notify the Contractor in writing of conditions detrimental to the work. Do not proceed with the installation until unsatisfactory conditions

have been corrected in a manner acceptable to the Installer and the Architect.

B. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.

PART 2 PRODUCTS

2.1 WOOD MATERIAL

A. General

1. All wood shall be sound, flat, straight, well seasoned, thoroughly dry and free from all defects. Warped or twisted wood shall not be used.

2. For miscellaneous wood blocking, grounds, furring as required, use Utility Grade Coastal Douglas Fir or Southern Pine, free from knots, shakes, rot or other defects, straight, square edges and straight grain, air seasoned with maximum moisture content of nineteen (19) percent. Wood shall be S4S, S-Dry, complying with PS-20.

3. For closet shelving, provide 3/4" thick A-A INT-APA plywood with 1/4" thick hardwood edges, fire retardant treated as specified herein.

4. Plywood and rough carpentry for telephone and electric closets, provide 3/4" thick C-D EXT-APA plywood, fire retardant treated as specified herein.

B. Wood Treatment

1. All interior wood material specified herein shall be fire retardant treated to comply with the AWPA standard U1 to achieve a flame spread rating of not more than 25 (UL Class "FR-S") when tested in accordance with UL Test 723 or ASTM E 84. The fire retardant chemicals used to treat the lumber must comply with FR-1 of AWPA Standard P49 and be free of halogens, sulfates and ammonium phosphate.

   a. Basis of Design: Arch Wood Protection Inc.; Dricon
   b. Other Acceptable Manufacturers:
      1). Koppers
      2). Hoover
   c. After treatment, kiln dry to a moisture content of fifteen (15) percent; if wood is to be painted or finished, kiln dry to a moisture content of twelve (12) percent.
   d. Provide UL approved identification on treated materials.

2. For exterior blocking, roofing and sheet metal, pressure treat wood with copper azole, Type B (CA-B); ammoniacal copper quat (ACQ) or similar preservative product that contains no arsenic or chromium. Preservative shall comply with AWPA Standard U1, (.25 lbs./cubic foot of chemical in wood).

   a. Basis of Design: Arch Wood Protection Inc.; Wolmanized Natural Select
   b. Other Acceptable Manufacturers:
      1). Koppers
      2). Hoover

c. After treatment, kiln dry to a maximum moisture content of fifteen (15) percent.

3. Treated wood which is cut or otherwise damaged shall be further treated in accordance with the AWPA Standard M-4.

2.2 HARDWARE

A. Rough Hardware for Treated Woods and Exterior Use: Hot-dipped galvanized or Type 304 stainless steel.

B. Nails: Common steel wire, untreated for interior work as per ASTM F 1667.

C. Bolts: Standard mild steel, square head machine bolts with square nuts and malleable iron or steel plate washers or carriage bolts with square nuts and cut washers conforming to the following:

1. Bolts: ASTM A 307, Grade A.

2. Nuts: ASTM A 563.

3. Lag Screws and Bolts: ASME B 18.2.1.

D. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2; use stainless steel for treated woods and exterior use.

E. Wood Screws: ASME B 18.6.1.

F. Concrete and Masonry Anchors: Standard expansion-shield self-drilling type concrete anchors where so shown or noted on the drawings, or where approved by the Architect.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where carpentry is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION OF FINISH HARDWARE

A. Hardware shall be carefully fitted and securely attached, in accordance with these specifications and the instructions of the various manufacturers.

B. Unless otherwise noted, mount hardware units at heights established in Section 081113.

C. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units which are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hair-line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.

G. All keys used shall be construction keys which are to be tagged with fiber discs as approved, clearly labeled with identifying inscriptions and then neatly arranged in a temporary cabinet. All construction keys shall be returned to the Owner.

H. Adjusting and Cleaning

1. Adjust and check each operating item of hardware and each door, to ensure proper operation and function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer (graphite type if no other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.

2. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make a final check and adjustment of all hardware items in such space or area. Clean and re-lubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.3 INSTALLATION OF DOORS AND FRAMES

A. Preparation

1. Remove welded-in shipping spreaders installed at factory.

2. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

3. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.

B. Installation

1. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

2. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. Install frames in accordance with ANSI/SDI A250.11, Recommended Erection Instructions for Steel Frames, unless more stringent requirements are specified herein.
    b. At fire-protection-rated openings, install frames according to NFPA 80.
    c. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    d. Install frames with removable glazing stops located on secure side of opening.
    e. Frames set in masonry walls shall have door silencers installed in frames before grouting.
    f. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    g. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

3. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with post-installed expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.

4. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames conforming to the requirements of Section 072100 "Thermal Insulation."

5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar; refer to Section 042000 "Unit Masonry" for installation of frames in masonry walls.

6. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

7. In-Place Gypsum Board Partitions: Secure frames in place with post-installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.

9. Installation Tolerances: Adjust steel door frames for squareness, alignment, twist, and plumb to the tolerance given in HMMA 841 of ANSI/NAAMM, current edition.

10. Steel Doors: Fit hollow metal doors accurately in frames to the tolerances given in HMMA 841 of ANSI/NAAMM, current edition.

    a. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

11. Glazing: Comply with installation requirements in Section 088000 "Glass and Glazing" and with standard steel door and frame manufacturer's written instructions.

    a. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c., and not more than 2 inches o.c. from each corner.

C. Wood Doors

1. Condition doors to average prevailing humidity in installation area prior to hanging.

2. Install doors in accordance with manufacturer’s instructions.

3. Fit door to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.

4. Clearances: Install doors to meet clearance requirements specified in Section 081416.

5. Fire-Rated Doors: Install in corresponding fire-rated frames in accordance with the requirements of NFPA No. 80. Provide clearances complying with the limitations of the authority having jurisdiction.

D. Adjustments: Check and readjust operating finish hardware items just prior to final inspection. Leave work in complete and proper operating condition. Remove and

replace defective work, including doors or frames which are warped, bowed or otherwise unacceptable.

3.4 BLOCKING AND MISCELLANEOUS WOOD

A. General

1. Erect rough carpentry true to line, levels and dimensions required; squared, aligned, plumbed, and securely fastened in place.

2. Shim where required to true up furring, blocking and the like. Use wood or metal shims only.

3. Do all cutting, fitting, drilling and tapping of other work as required to secure work in place and to perform the work included herein. Do all the cutting and fitting of carpentry work, for the work of other trades as required.

B. Blocking and Miscellaneous Wood

1. Furnish and install all wood grounds, furring, blocking, curbs, bucks, nailers, etc., that may be necessary and required in connection with the carpentry and with the work described for any other trades and including required carpentry for electrical fixtures. All blocking and nailers shall be continuous wherever required, whether or not so indicated.

2. Blocking shall be as required for the proper installation of the finished work and for items in mechanical sections as required. Blocking, edgings, stops, nailing strips, etc., shall be continuous, unless distinctly noted otherwise. Provide blocking as required to install all equipment. Provide blocking and nailers where shown or required to fasten interior sheet metal work.

3. Fastening for wood grounds, furring and blocking shall be of metal and of type and spacing as best suited to conditions. Hardened steel nails, expansion screws, toggle bolts, self-clinching nails, metal plugs, inserts or similar fastenings shall be used, of suitable type and size to draw the members into place and securely hold same.

C. Rough Lumber for Roofing and Sheet Metal

1. Furnish and install all wood nailing strips and wood blocking required in connection with respective types of roofing, fans, flashings, and sheet metal work, using preservative treated wood as herein before specified.

2. Wood blocking shall be of sizes and shapes as indicated on the drawings and/or designed for the reception of curb flashings for roof ventilators and similar items.

3. All nailing strips and blocking shall be carried out in accordance with the printed installation instructions, and/or recommendations of the accepted manufacturer of the roofing materials, and in coordination and cooperation with the sheet metal work trades.

4. All blocking and nailing strips shall be firmly secured in place using counter bored bolt and nut fastenings, or secured by any other proposed flush surfaced fastenings.

5. Wood nailing strips or blocking required to be embedded in concrete work shall be furnished in time due for placing, prior to start of concrete operations. Locations and spacings of nailing strips or blocking shall be performed in coordination with the concrete trades, as required for respective installations.

3.5 TELEPHONE AND ELECTRIC EQUIPMENT MOUNTING BOARDS

A. Furnish and install 3/4" thick plywood panels to the walls of the telephone and electric equipment rooms in accordance with the requirements of the local utility company.

B. Secure to wall using proper devices for substrates encountered, spaced twelve (12) inches o.c., maximum around the edges, 1-1/2" from corners, and in three (3) rows of three (3) each in the field. Recess fastening devices flush with the plywood surface. Adjacent panels shall be butted with 1/16" space between without lapping.

3.6 ROUGH HARDWARE

A. Securely fasten rough carpentry together. Nail, spike, lag screw or bolt as required by conditions encountered in the field and the Contract Documents.

B. Provide rough or framing hardware, such as nails, screws, bolts, anchors, hangers, clips, inserts, miscellaneous fastenings, and similar items of the best quality and of the proper size and kind to adequately secure the work together and in place, in a rigid and substantial manner.

C. Secure rough carpentry to masonry with countersunk bolts in expansion sleeves or other acceptable manner, with fastenings not more than sixteen (16) inches apart. Secure woodwork to hollow masonry with toggle bolts spaced not more than sixteen (16) inches apart.

D. Countersink bolts in nailers and other rough woodwork and include washers and nuts. Cut bolts off flush with surfaces and peen as may be required to receive finished work.

E. Inserts to secure wood nailers to concrete shall be malleable iron threaded inserts with 3/8" diameter bolts of length to allow for countersinking. Locate at end of each nailer and at intervals not exceeding thirty (30) inches o.c.

F. Furnish to the mason for building into the work, or attaching the work which is to be built in, anchors, bolts, wall plates bolted to masonry, corrugated wall plugs, nailing blocks, etc., which are required for the proper fastening and installation for the work or other items as called for in this Section.

G. Detailed instructions with sketches of necessary requirements, shall be given to the masonry trade showing the location and other details of such nailing devices.

3.7 CLEANING UP

A. General: Keep the premises in a neat, safe and orderly condition at all times during execution of this portion of the work, free from accumulation of sawdust, cut-ends and debris.

B. Sweeping

1. At the end of each working day, or more often if necessary, thoroughly sweep all surfaces where refuse from this portion of the work has settled.

2. Remove the refuse to the area of the job site set aside for its storage.

3. Upon completion of this portion of the work, thoroughly broom clean all surfaces.

END OF SECTION

SECTION 064023

ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the architectural woodwork as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Wood trim, moldings, base, frames and rails.
2. Wood casework and counters with plastic laminate finish.
3. Hardware for casework.
4. Wood shelving.
5. Solid surfacing counters.
6. Metal panels
7. Banquettes.
8. Wood framing and rough lumber as required for work of this Section.
9. Wood grounds, blocking, nailers, furring as required for work of this Section.
10. All rough hardware and fastenings for work of this Section.
11. Drilling concrete and masonry, drilling and/or tapping metal work, as required, for the installation of work of this Section.
12. Back painting as specified herein.
13. Shop finish of work of this Section, except items indicated herein to be shop primed only.

1.3 RELATED SECTIONS

A. Carpentry - Section 062000.

B. Caulking between architectural woodwork and any wall, floor, or ceiling joints - Section 079200.

C. Wood doors - Section 081416.

D. Field finishing - Section 099000.

1.4 QUALITY STANDARDS

A. The quality standards of the Architectural Woodwork Institute, "Architectural Woodwork Standards," 2nd Edition, dated October 1, 2014, and enhancements 2019 shall apply to all workmanship including materials and installation, for architectural woodwork and by reference are made a part of this specification. All work shall conform to "Premium" grade requirements of the AWI "Architectural Woodwork Standards," unless otherwise modified herein.

B. In the event of a dispute as to the quality grade (or grades), the Contractor shall call upon the Architectural Woodwork Institute for an inspection under AWI's Quality Certification Program which shall include a QCP Inspection and Report. The Contractor agrees to abide by the decision of this Report. The cost of said inspection and report shall be borne by the Contractor.

C. Employ only tradesmen experienced in the fabrication and installation of architectural woodwork.

D. Woodworking firm must be accredited by the AWI Quality Certification Program (QCP).

E. Provide fire test reports by an accredited testing laboratory of all woodwork demonstrating compliance with fire rating classification as required by Code,.

1.5 SUBMITTALS

A. Shop Drawings

1. Submit shop drawings of all woodwork specified and indicated on the drawings. Shop drawings shall indicate room plans and elevations at 3/4" equals 1'-0" scale and typical construction details at 3" equals 1'-0" scale. Shop drawings shall indicate all materials, thicknesses and finishes.

2. Shop drawings shall show all finish hardware, anchors, fastenings and accessories.

3. Shop drawings shall show all jointing, joint treatment and butt jointing in veneers and plastic laminate.

4. Shop drawings for cabinet work must show centerline height and horizontal location of all required internal wall blocking.

5. Where architectural woodwork deviates from AWI standards noted herein, shop drawings must identify these deviations.

B. Samples: Submit samples of each of the following items:

1. Plastic laminate, twelve (12) inches square, including a section of outside corner.

2. Each type and finish of each type of wood cornice, trim, molding, etc., eight (8) inches long, finish as specified.

3. Solid surfacing counter, twelve (12) inches square, including a section of outside corner.

4. Cabinet hardware.

1.6 QUALIFICATIONS

A. The work of this Section shall be provided by a firm having a minimum of five (5) years' experience on projects of similar size and quality to that specified and shown.

1.7 COORDINATION

A. Coordinate the work of this Section with other appropriate Sections of the specifications to ensure proper scheduling for fabrication and installation of the work specified herein

B. Coordinate with partition and finish trades to ensure that proper provisions are made for the installation of the work specified herein.

C. Verify all dimensions in the field prior to fabrication of all Architectural Woodwork to ensure proper fit.

1.8 PRODUCT HANDLING

A. All materials and work of this Section shall be protected from damage, from time of shipment from shop to final acceptance of work. Cover, ventilate, and protect work of this Section from damage caused by weather, moisture, heat, staining, dirt, abrasions, any other causes which may adversely affect appearance or use, or which may cause deterioration of finish, warping, distortion, twisting, opening of joints and seams, delamination, loosening, etc., of work of this Section.

B. Keep all finish carpentry, millwork, and cabinet work under cover both in transit and at the premises. Do not deliver any finish carpentry, millwork or cabinet work before it is required for installation. Protect such work to avoid damage in transit, during erection and after erection until acceptance of the building; use all such methods to provide the proper protection. Remove such protection when directed by the Architect.

C. Deliver finish carpentry, millwork, and cabinet work in a dry stable condition; protect same against injury and dampness. Do not store or install finish carpentry, millwork or cabinet work until after the concrete, masonry and plaster work are thoroughly dry.

D. Damaged or defective items of work of this Section are subject to rejection and replacement with new by Contractor, at no cost to Owner.

1.9 JOB CONDITIONS

A. Humidity Controls: The ambient relative humidity at the site, including both the storage and the installation areas, shall be maintained between 25% and 55% prior to delivery and through the life of the installation.

B. Determine equilibrium moisture content and maintain required temperature and relative humidity as required for a tolerance of plus or minus one (1) percent of the specified optimum moisture content until woodwork receives specified finishes. Refer to "Guide to Wood Species Selection," AWI, for method of determining equilibrium moisture content values.

C. Examination of Substrate and Conditions: The installer must examine the substrate and the conditions under which the work of this Section is to be performed, and notify the

D. Contractor in writing of unsatisfactory conditions. Do not proceed with work under this Section until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

E. Areas to receive architectural woodwork must be fully enclosed with windows and/or

curtain wall installed and glazed, exterior door in place, HVAC systems operational and temporary openings closed. Any plaster, wet grinding and concrete work shall be fully dry.

F. Architectural woodwork shall be allowed to come to equilibrium on site for 7 days prior to installation.

PART 2 PRODUCTS

2.1 BASIC REQUIREMENTS

A. Wood Moisture Content: Provide kiln-dried (KD) lumber with an average moisture content range of nine (9) to twelve (12) percent for exterior work and six (6) to eleven (11) percent for interior work.

B. Measurements: Before proceeding with woodwork required to be fitted to other construction, obtain field measurements and verify all dimensions of shop drawing details as required for accurate fit.

C. Compatibility of Grain and Color: Architect reserves the right to select materials for best compatibility between visually related members and veneers.

D. Machine and sand woodwork to comply with requirements of Standards for specified grade.

E. Fabricate woodwork to dimensions, profiles and details shown. Rout or groove back of flat trim members, kerf backs of other wide flat members except plywood or veneered members.

F. Miter joints by joining, splining and gluing to comply with requirements for the specified grade.

G. Inspect each piece of lumber and plywood or each unit of woodwork after drying; do not use twisted, warped, bowed of otherwise damaged or defective wood.

2.2 GENERAL - MATERIALS

A. Softwood lumber shall conform to the requirements of the latest edition of American Lumber Standards Simplified Practice Recommendation R-16. Grades shall conform to the grading rules of the Association having jurisdiction, and shall bear the official grade and trademark of the Inspection Bureau of the Association and a mark of mill identification.

B. Framing and Rough Lumber: No. 1 KD grade Southern Pine or Dense Construction grade Douglas Fir, having extreme fiber in bending stress of at least 1700 psi, surfaced four sides (S4S). Provide fire retardant treatment meeting requirements of Section 062000.

C. Grounds, Blocking, Nailers, Furring: Southern Pine, Douglas Fir or Sitka Spruce, grade to suit particular purpose and to be straight, square edged, straight grained, surfaced four sides (S4S), and which will retain nails and screws without splitting. Provide fire retardant treatment.

D. Wood Veneers and Lumber: Provide AWI Premium Grade materials and workmanship. For species not listed in the AWS comply with the following:

1. Provide AWS Lumber Grade Premium and AWS Grade AA Veneer, book- matched, minimum 6 inch face veneer width. Kiln dry to 6-8 percent moisture content. Components shall be free of defects and sapwood. Match adjacent pieces for color and grain pattern.

2. Single-Source Requirement for Wood Veneers and Solids: Intent is to provide wood which matches as closely as possible throughout the project. Provide wood veneers and solids from the same distributor, and from the same flitches and solids sources to the greatest extent possible.

E. Lumber: AWI Section 3 with the following requirements:

1. Hardwood for Transparent Finish: Premium Grade, select Rift Sawn species as selected by Architect matching adjoining veneers unless otherwise shown or specified, and free from cat's eyes, bird's eyes, burls, curls or cross grains.

2. Hardwood for Opaque Finish: Any hardwood which, when finished, will not show any grain, imperfection or other surface defects when used with the opaque finish specified.

F. Plywood: AWI Section 4; Veneer core, particleboard, or plywood core unless otherwise specified, and with the following requirements:

1. Hardwood: Premium Grade, face veneers as shown or specified

2. Particleboard: Premium Grade, Duraflake for cabinets. In addition, particleboard and MDF shall be certified to the following EPP CPA 3-08 formaldehyde emission limits:

a. Particleboard meets 0.18 ppm.
b. MDF meets 0.21 ppm.

3. Edges: Banded with hardwood in accordance with Premium Grade Standards.

G. Wood Species and Cut for Transparent Finish: Quarter sliced/sawn species as selected by the Architect.

H. Finishing (Wood)

1. Transparent Finish for Trim and Bases

a. AWI Factory Finish System "Conversion Varnish", System 5, Transparent.
b. AWI Premium Grade.
c. Stain: As selected by the Architect.
d. Degree of Sheen: As selected by the Architect.

2.3 PLASTIC LAMINATE

A. Face Sheets: NEMA Publication LD3, Grade GP50, Type I, 0.05" thick.

1. Basis of Design Manufacturer: Wilsonart

2. Other Acceptable Manufacturers:

a. Formica
b. Nevamar

3. Color, Pattern and Finish: Refer to Drawings.

B. Backing Sheets: Non-decorative, high-pressure plastic laminate, NEMA LD3, Grade BK20, 0.02" thick.

C. Edges: Finish with plastic laminate to match face and applied before face sheets are applied, unless otherwise shown or specified.

2.4 METAL

A. Specialty Metal by Moz per finish schedule.

B. Steel

1. Structural Steel Shapes and Plates: ASTM A 36.

2. Hot-Rolled Carbon Steel Sheets: Commercial quality, ASTM A 569, may be used for concealed parts only.

3. Finishes

a. Primer for Unexposed Metal: See Section 099000.

2.5 BANQUETTE SEATING

A. Frames: Constructed of selected kiln-dried hardwood of 4/4 stock surfaced two sides which are doweled, glued, nailed and screws. All joints shall be reinforced with glue-blocks and all oak wood upright members shall be placed on approximately 24" center lines.

B. Backs: Back cushion to be 5" thick polyurethane foam rubber and dacron filled. Upholstery details are tuck and welted on all cushions. All upholstered seats shall be set over 3/4" plywood panel which is screw mounted to frame. Tops of cushions extend above padded frame capping.

C. Seats: To be loose cushion effect with 3/4" plywood panel. Base fitted with perma-mesh springs and over these springs will be 4" thick 2.8 density and 40 lb. compression foam plus dacron. All seats have locking blocks and shall be removable. Stainless steel no sag springs.

D. All foam in seats and back shall be encapsulated with "Therma Block" wrapping made by DuPont, type as required by upholstery conditions encountered.Upholstery Fabric: See Finish Schedule.

F. Upholstered built-in banquettes shall meet California Technical Bulletin 133 (CAL 133) full seat fire test. Products shall be halogenated flame retardant free.

2.6 GLASS

A. Comply with the requirements of Section 088000; glass shall be as selected by the Architect.

2.7 MISCELLANEOUS PRODUCTS

A. Fasteners

1. Wood Screws: FS FF-S-111, type, size, material and finish as required for the condition of use.

2. Nails: FS FF-N-105, type, size, material and finish as required for the condition of use.

3. Anchors: Type, size, material and finish as required for the condition of use.

4. Staples: Upholstery type staples of sufficient strength to hold fabric taut in place without sagging.

B. Adhesives

1. For Laminating Plastic Laminate Surfaces: Urea resin, Type II, as recommended by fabricator.

2. For All Other Uses: Polyvinyl acetate resin emulsion or other type as recommended by the fabricator.

2.8 CABINETS WITH PLASTIC LAMINATE FINISH

A. General

1. Fabricate all cabinetry and millwork to the "Premium Grade" standards of the AWI, Section 10.

2. Face construction of cabinets shall be "Flush Overlay."

3. Provide 3/4" thick doors, drawer fronts and fixed panels (including thickness of plastic) except where required to be thicker by Standards; and provide flush units.

4. Provide dust panels of 1/4" thick plywood or tempered hardboard above compartments and drawers, except where located directly below countertops.

5. Exposed Edges: Plastic laminate matching exposed panel surfaces. Ease exposed edge of overlap sheet.

B. Plastic Laminate

1. Plastic Laminate for Horizontal Surfaces: 0.050" thick, general purpose type (high pressure).

2. Plastic Laminate for External Vertical Surfaces: 0.028" thick, general purpose type (high pressure).

3. Plastic Laminate for Post Forming: 0.042" thick, post forming (high pressure).

4. Plastic Laminate for Cabinet Linings: 0.020" thick, cabinet liner (high pressure).

5. Plastic Laminate for Concealed Panel Backing: 0.020" thick, backer type (high pressure).

6. Plastic Laminate Colors and Patterns: As selected by the Architect from manufacturer's standard satin finish products. Acceptable Manufacturers: Wilson-Art, Nevamar, Formica.

7. Basis of Design Manufacturer: Wilsonart

8. Other Acceptable Manufacturers:

   a. Formica
   b. Nevamar

9. Color, Pattern and Finish: Refer to Drawings.

A. Shop Assembly: All work shall be shop assembled. Work that is too large for entrance into the use area shall be fabricated in attachable sections with provisions for reconnection in the using space.

B. Material Thicknesses: See drawings for general materials thicknesses. Minimum thickness of solid lumber for web frames, trim, bases, etc., shall be 3/4". Minimum thickness of plywood and particleboard shall be 3/4".

C. Sizes: See drawings for woodwork sizes required. The manufacturer shall check field dimensions and verify all openings and actual field conditions prior to fabrication of work.

D. Manufacturer is responsible for rigidity and structural stability.

2.9 PLASTIC LAMINATE COUNTERTOPS AND VANITIES

A. Grade: Same as AWI grade required for cabinet work; plastic laminate finish.

B. Construction

1. Provide back-splash and end-splash, where detailed; top-mounted square butt joint, fully covered with matching plastic laminate, eased edges.

2. Exposed Counter Edges: Plastic laminate matching surface, except as otherwise indicated. Ease exposed edges of overlap sheet.

3. Cut openings for equipment to be installed. Comply with equipment manufacturer's requirements, but provide internal corners of 1/8" minimum radius. Smooth saw cut and ease edges.

4. Seal cut edges of counter at openings for sinks and other "wet" equipment, using waterproofing compound recommended by plastic manufacturer and compatible with laminating adhesive.

2.10 CABINET HARDWARE

A. Architectural Woodwork Hardware

1. Hinges: Concealed hinges.

a. Basis of Design: Hafele; Concealed hinges.

2. Catches: Magnetic; top and bottom.

3. Pulls: As selected by the Architect.

4. Locks: As selected by the Architect.

5. Drawer Slides (24” maximum width): Full extension, 100 lb. capacity.

a. Basis of Design: Accuride, Model 7434.

6. Drawer Slides (16” maximum width) Easy Close: Full extension, 100 lb. capacity.

a. Basis of Design: Accuride, Model 3832C.

7. Shelf Supports: Pin and grommet system.

a. Basis of Design: Hafele; No. 282.01.701 pin and 282.50.704 grommet.

8. Finish: Satin Stainless Steel.

9. Closet Hardware: Oval wardrobe rails, chrome plated steel with center bracket and wall support brackets.

a. Basis of Design: Hafele

2.11 WOOD FOR RAILS, CAPS, TRIM, BASES, MOLDINGS AND FRAMES

A. Quality Standard: For the following types of interior architectural woodwork, comply with indicated standards as applicable.

1. Standing and Running Trim: AWI Section 6.

2. Miscellaneous Millwork: AWI Section 6.

3. Stair Handrails: AWI Section 7.

B. Woodwork for Transparent Finish: Except as otherwise indicated, comply with the following:

1. Grade: Premium.

2. Species of Solid Wood: Quarter Sawn Species as noted on drawings.

C. Woodwork for Paint Finish: Except as otherwise indicated, comply with the following:

1. Grade: Premium.

2. Species of Solid Wood: Solid, paint grade, sound clear Poplar or Birch.

2.12 SOLID SURFACING COUNTERS

A. Composition Solid-Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

B. Basis of Design: Wilsonart LLC; 051 Solid Surface Material.

1. Thickness: 1/2″

2. Color: As selected by the Architect.

C. Other Acceptable Manufacturers:

1. Avonite Surfaces.

2. E. I. du Pont de Nemours and Company.

3. Formica Corporation.

4. LG Chemical, Ltd.

D. Joints: Fabricate countertops without joints. For very large counters where fabricating without joints is not possible, adhesively join counters with no exposed seams.

E. Adhesive: Product recommended by solid surface material manufacturer. At joints, use adhesive to create inconspicuous, non-porous joints

F. Sealant: Manufacturer's standard mildew-resistant, FDA/UL recognized silicone sealant in colors matching components.

G. Fabrication

1. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

a. Grade: Premium.

2. Fabricator must be approved by the solid surface manufacturer.

3. Factory fabricate components to custom sizes and shapes indicated, in accordance with approved shop drawings.

4. Form joints between components using manufacturer's standard joint adhesive; without conspicuous joints.

5. Provide factory cutouts for plumbing fittings and accessories as indicated on the drawings.Cut and finish component edges with clean, sharp returns. Route radii and contours to template. Repair or

reject defective and inaccurate work.

H. Warranty: The manufacturer shall warrant to the Owner that manufacturer will at its option repair or replace without charge, such product if it fails due to a manufacturing defect during the first 10 years after initial installation. This includes all labor charges needed to repair or replace the product covered hereunder.

2.13 FABRICATION - GENERAL

A. Provide lumber framing for architectural woodwork, complete with all bracing and fastening devices as required for a rigid installation, and as required to sustain the imposed loads.

B. Do all fabrication from field measurement with provision for scribing as required to meet built-in conditions.

C. Coordinate the work of this Section with the work of other trades.

D. Fabricate units in largest practicable sections. Assemble in the shop for trial fit, disassemble for shipment and reassemble with concealed fasteners.

E. Maintain relative humidity and temperature during fabrication, storage and finishing operations matching that of the areas of installation.

F. Details indicate the required type and quality of construction. Modifications to conform to manufacturer's standards will be considered providing they comply with the Contract Documents, maintain the profiles shown and subject to acceptance by the Architect.

G. Reinforcing shown is minimum. Provide additional reinforcing as required to ensure a rigid assembly. Exposed surfaces shall be free from dents, tool marks, warpage, buckle, glue and open joints, or other defects affecting serviceability or appearance. Accurately fit all joints, corners and miters. Conceal all fasteners. Make threaded connections up tight so that threads are entirely concealed.

H. Factory finish all items where possible. Defer final touch-up, cleaning and polishing until after delivery and installation.

I. Comply with AWI, Premium Grade standards for sanding, filling countersunk fasteners, back priming and similar preparations for the finishing of architectural woodwork, as applicable to each unit of work.

J. Prepare all countersunk wood screw attachments for wood plugs. Wood plugs shall match surrounding species and grain direction; putty filling is not acceptable.

2.14 FABRICATION - SPECIFIC ITEMS

A. Casework

1. Include all preparations for mechanical, electrical, telephone and plumbing work required.

2. Provide cabinet hardware for casework as shown.

3. Provide dust panels in body webs and between drawer units.

4. Provide plastic laminate for exposed surfaces as specified herein before.

5. Hollow core doors will not be permitted.

6. Provide matching plastic laminate for edge treatments of case body members.

7. Provide drawers with slides as specified. Drawers shall not rest on web body frames.

B. Closet and Storage Shelving

1. Provide closet and storage shelving in accordance with AWI Section 600, Custom Grade, unless otherwise shown or specified.

2. Exposed edges shall have hardwood edge bands.

C. Standing and Running Trim: Provide standing and running trim of the sizes, profiles, species and finish as specified or shown and complying with AWI Section 6, Premium Grade.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where architectural woodwork is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 FRAMING

A. Use specified framing lumber, sizes and spacing as indicated on drawings and as required to support loads.

B. Framing shall be cut square on bearings, closely fitted, accurately set to required lines and levels, rigidly secured in place at bearings and connection with nails, lag screws and/or bolts as required by conditions.

3.3 GROUNDS, BLOCKING, NAILERS AND FURRING

A. Provide all wood grounds, blocking, nailers, furring, and the like for work of this Section, where shown and where required, dressed to size indicated or required to suit the condition. Install grounds, blocking, nailers, furring, etc., rigidly, in proper alignment, trued with a long straight edge.

3.4 ROUGH HARDWARE

A. Provide all rough hardware, such as nails, screws, bolts, anchors, hangers, clips and similar items. Hardware shall be of the proper size and kind to adequately secure the work together and in place, in a rigid and substantial manner. Use galvanized hardware at exterior walls, and at other locations where subject to moisture or where water will be present.

B. Secure wood to concrete and to solid masonry with countersunk bolts in expansion sleeves or other approved manner, to steel with countersunk bolts, to hollow masonry and to drywall with heavy duty countersunk toggle bolts. Space fastenings not more than

sixteen (16) inches apart. Hardened cut nails, power-driven fastenings, or other suitable devices may be used where approved by the Architect.

C. Connections and fastenings shall be made in such manner as will compensate for swelling and shrinkage and shall permit the work to remain permanently in place without any splitting or opening of joints.

3.5 INSTALLATION OF CABINET FINISH HARDWARE

A. All items of finish hardware furnished under this Section shall be carefully fitted and secured in place as part of the work of this Section. Locations and positioning of hardware shall be subject to the Architect's approval. Care shall be taken not to mar or damage hardware, or other work. Install doors plumb and true. Hardware shall be fitted to ensure operation without forcing.

B. After preliminary fitting of hardware, the Contractor shall remove trim for painting and finishing work; after which he shall reinstall the hardware in a permanent manner.

C. Upon completion of the work, before final acceptance of the building by the Owner, the Contractor shall, in the presence of the Architect, show that all hardware is in satisfactory working order; fit all keys in their respective locks and, upon acceptance of the work, shall tag and deliver all keys to the Architect and Owner.

D. When directed by the Owner, at any time during the first year after the completion of the Contract, the Contractor shall return to the building and adjust and refit the work and hardware, and leave such items in satisfactory working order.

3.6 GENERAL INSTALLATION

A. Wall anchorage and general installation procedures for cabinetry work shall conform to AWI Section 10, Article entitled "EXECUTION", Sub-Article 6.1 with all related sub-paragraphs.

B. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including countertops), and with 1/16" maximum offset in flush adjoining surfaces, 1/8" maximum offset in revealed adjoining surfaces.

C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.

3.7 TRIM, MOLDINGS, ETC.

A. Install with minimum number of joints possible, using full-length pieces for each run. Stagger joints in adjacent and related members. Cope at returns, miter corner. Joints of all trim and/or moldings shall be set tight, miter exterior angles and cope interior angles. Joints, except end joints less than twelve (12) feet apart, will not be permitted in straight runs of trim and/or moldings and rails.

B. Secure all trim and/or moldings with glue and blind nail with finishing nails. Set exposed nail heads in finished work and putty. Sand all work to remove any tool marks and irregularities.

3.8 WOOD RAILS

A. Wood shall be planed straight, square and level, then sanded smooth with flush finished surfaces. Joints shall occur over supports. Right angle joints shall be mitered.

B. All exposed fastening devices shall be countersunk and set below finished wood surfaces, and fitted with matching wood plugs; sand plugs and finish smooth and flush with exposed surfaces.

C. Handrails shall be capable of withstanding a force of two hundred (200) lbs. applied to rail at any point from any direction.

D. Provide all hardware and metal supports required for complete installation as detailed on drawings.

3.9 CLOSET AND STORAGE SHELVING

A. Provide closet and storage shelving at the locations shown. Provide hang rods where shown. Set adjustable center hangers.

3.10 CABINET WORK AND MILLWORK

A. General

1. Materials and workmanship shall conform to the Quality Standards of the Architectural Woodwork Institute specified herein and to the drawings.

2. Cabinet work and millwork shall be performed by experienced cabinet work and millwork company, having craftsmen skilled in their trade.

3. Fabricate all cabinet work and millwork completely in the shop, in complete and/or as large units as practical, leaving only fitting, assembly, installation and a minimum of fabrication and finishing to be done at the building. Assembled work shall be rigidly secured and permanently fastened together with concealed fasteners.

4. Afford Architect every facility for inspection of work at shop or mill at such times as the Architect may select.

5. As far as practicable, use concealed fastenings for joining and assembling the work. Where this is impossible, the means of securing shall be placed in inconspicuous places and methods of joining and assembling submitted for Architect’s approval prior to fabrication.

6. Mill all finish wood accurately to detail, with clean cut moldings, profiles and lines, machined, sanded smooth, housed, jointed, blocked, put together in the best

manner, with provision for swelling and shrinkage, and to ensure the work remaining in place without warping, splitting or opening of joints.

7. Cut trim to dimensions and profiles shown, from solid stock.

8. Make all trim and the like in single lengths wherever possible; joints mitered, glued and splined. Continuous members shall have tight flush joints, doweled or splined and glued.

9. Make all joints hairline tight, fitted accurately and joined with hardwood splines or dowels, glued together, or by other method approved by Architect. Use screws, not nails, for fastenings.

10. Gluing shall, where practicable, be by the hot plate press method and glued surfaces shall be in close contact throughout. Glue stains on finished work will not be permitted.

11. Cover surface fastenings, where permitted, with matching wood plugs or wood putty. Finish exposed edges of plywood with matching solid stock. Lock miter external corners; tongue and groove internal corners to allow for contraction and expansion.

12. Machine sand with grain, finish with hand sanding, leave exposed surfaces free from machine or tool marks that will show through the finish.

13. Work which adjoins drywall, concrete, or other finish shall be fitted and scribed in a careful manner and ample allowance shall be given for cutting and scribing.

14. Erect work true to lines, levels and dimensions, square, aligned and plumb, securely and rigidly fastened in place.

B. Cabinet Work: Provide all items of cabinet work indicated on drawings and as herein specified.

1. Tops, sides, backs, bottoms, dividers, shelves, fronts, doors and drawer fronts shall be of plywood or flakeboard core, with the specified wood veneer or plastic laminate as indicated on drawings.

2. Drawer sides and backs shall be 1/2" thick solid clear selected white birch, suitable for clear finish. Drawer bottom shall be 3/8" thick plywood with clear selected white birch veneers, suitable for clear finish.

3. Cabinet doors and drawers shall be flush mounted.

4. Adjustable shelves in cabinets shall have grommets spaced 2" o.c.

5. Fixed shelves shall be dadoed into side supports and glued.

6. Shelves shall be 3/4" thick for spans up to 30"; for spans in excess of 30" to 48" shelves shall be 1" thick.

7. All cabinets shall have closed top, sides, bottom, and back with plastic laminate to match face work. Cabinets to fit accurately into indicated locations; scribe moldings permitted only where indicated.

8. Countertops, counters, counter fronts, shelves, etc., indicated on drawings to have plastic laminate, shall have plastic laminate shop applied to 3/4" thick core, with plastic laminate backing sheet on underside or back of countertops, counters and shelves. Plastic laminate shall be pressure laminated to core with laminate at external corners. Provide concealed wood framing to support plastic laminate counters, securely fastened to wall and to underside of counters.

C. Countertops shall be installed to support a minimum concentrated live load of 150 lbs. acting downward at mid span at outer edge of counter without causing deformation and damage.

3.11 WOOD BASES

A. Provide plywood backing, toggle bolted to substrate, if substrate not suitable for securing wood base.

B. Machine wood bases from specified wood, to profiles indicated on drawings.

C. Set base level and plumb. Where indicated on drawings, face of wood base shall be flush with wall above. Glue wood base to substrate or to plywood backing, and screw or nail wood base to substrate or to plywood backing with countersunk wood screws or with finishing nails, recess wood screw heads, and spackle with wood putty, set and spackle nails with wood putty. Do not nail or fasten wood base to floor. Ends of wood base shall be either splined or ship lapped.

D. Where no wood backing occurs, screw apply base at each stud with screw countersunk and wood putty applied and sanded smooth and flush with base.

3.12 WOOD DOOR FRAMES

A. Where indicated on drawings, provide wood frames and bucks for wood doors. Bucks shall be braced, set straight and plumb and have anchors for building into adjoining construction; space anchors not over two (2) feet apart (one foot from corners). Machine wood frames from specified solid wood to profiles indicated on drawings. Set frames plumb, level, square; securely attached to adjoining construction. Wood frames, bucks and trim shall conform to details.

3.13 PAINTING AND FINISHING

A. General: All painting and finishing work of this Section shall be shop applied, unless otherwise noted, as specified below. All painting and finishing shall match approved samples. Field finish painting, where specified below, shall be by painting Subcontractor, as specified for in Painting Section.

B. Schedule of Painting and Finishing

1. Shop Primer On:

a. Ferrous metal work.

2. Shop Natural Finish On:

a. Wood bases (except where existing to be finished in field).
b. Wood trim and moldings.

C. Back-Painting: All work of this Section in contact with concrete or masonry or other moisture areas and all concealed surfaces of cabinet and millwork, shall be back-painted with one (1) coat of oil based paint prior to installation, shop applied where practicable.

D. Field Touch-Up: Field touch-up shall be the responsibility of the installing Subcontractor, and shall include the filling and touch-up of exposed job made nail or screw holes, refinishing of raw surfaces resulting from job fitting, repair of job inflicted scratches and mars, and final cleaning up of the finished surfaces.

3.14 CLEAN UP AND PROTECTION

A. Clean Up: At regular intervals during the course of the work, all debris and excess material shall be cleaned up and removed from the site. Upon completion of installation, clean all spaces of debris caused by woodwork installation.

B. Protection: Protect all woodwork from marring, defacement of other damage until final completion and acceptance of the project by the Owner. Repair or replace all defective units prior to final inspection as directed by the Architect. Any units that cannot be satisfactorily repaired in the opinion of the Architect shall be replaced with new units of same original design, at no additional cost to the Owner.

END OF SECTION

SECTION 07 21 00 -

BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Batt insulation in exterior wall construction.
2. Sound attenuation insulation in interior walls and ceilings

B. Related sections include but are not limited to:

1. Section 05 40 00 – Cold Formed Metal Framing.
2. Section 09 29 00 – Gypsum Board.

1.2 SUBMITTALS

A. Product Data:

1. Submit data on product characteristics, performance criteria, and limitations.

B. Manufacturer's Installation Instructions:

1. Submit special environmental conditions required for installation and installation techniques.

C. Manufacturer's Certificate:

1. Certify that products meet or exceed specified requirements.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Do not install adhesives when temperature or weather conditions are detrimental to successful installation.

1.5 COORDINATION

A. Coordinate the Work with Section 07 25 00 for installation of vapor retarder and air seal materials.

PART 2 - PRODUCTS

2.1 BATT INSULATION

A. Manufacturers: Provide one of the following:

1. Owens Corning; Thermal Spread 25 Insulation.
2. Certainteed; Flame-Resistant Foil Insulation (FSK-25).
3. Manville; FSK-25 Fiber Glass Thermal Insulation.
4. Knauf Fiber Glass; FSK-25 Batt Insulation.Or approved equal.

B. Batt Insulation (Type 1): ASTM C665, Type III, Class A preformed glass fiber batt type, fire resistant foil reinforced Kraft faced one side, with maximum flame/smoke properties of 25/450 in accordance with ASTM E84.

C. Thermal Resistance: Indicated on Drawings; 6-inches thick, R-19; 8½ - 9-inches thick, R-30, etc.

D. Batt Size: Friction fit of sizes to fit stud spacings.

2.2 FIRESAFING BATT INSULATION

A. Manufacturers: Provide one of the following:

1. United States Gypsum Company; Thermafiber Sound Attenuation Fire Blankets (SAFB).
2. Or approved equal.

B. Batt Insulation (Type 2): ASTM C665, Type I, unfaced semi rigid mineral fiber batt type, 2.5 pcf density, 3 inches thick, with maximum flame/smoke properties of 15 /0 in accordance with ASTM E84.

C. Batt Size: Friction fit of sizes to fit stud spacings.

2.3 THERMAFIBER SOUND INSULATION

A. Thermafiber insulation: A mineral fiber product (ASTM C-665) ideal for improving sound control in partition and floor/ceiling assemblies. Use thickness on drawings or manufacturer recommendation. Use formaldehyde free batts. Sound Attenuation Fire Blankets (SAFB): Paperless semi-rigid mineral fiber mats designed to improve STC ratings when installed in steel stud partitions and wood frame construction. Fire safety FS-15 blankets are used to provide non-combustible exterior wall furring and steel stud curtain wall assemblies. They are open faced and require separate vapor retarder. Use thickness indicated / as per manufacturer's recommendations

2.4 ACCESSORIES

A. Adhesive for Cavity Wall Insulation: Type recommended by insulation manufacturer for application.

B. Adhesive at Other Locations: Type recommended by insulation manufacturer for application.

C. Tape: Bright aluminum self-adhering type for foil faced insulation.

D. Wood Blocking: Preservative treated wood blocking as specified in Section 06 10 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.

B. Verify substrate surface is flat, free of honeycomb, fins, irregularities, materials or substances that may impede adhesive bond.INSTALLATION - BATT INSULATION

C. Install in exterior walls, roof and ceiling spaces without gaps or voids. Fluff insulation to full thickness for code compliant R-value before installation. Do not compress insulation.

D. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

E. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.

F. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

G. Tape in place.

H. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

I. Metal Framing: Place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.

J. Extend vapor retarder tight to full perimeter of adjacent window and door frames and other items interrupting the plane of membrane. Tape seal in place.

3.2 INSTALLATION - NAILABLE INSULATION

A. Install insulation with mechanical fasteners in accordance with insulation manufacturer's instructions.

B. Install wood blocking continuous along eave and rake . Use thickness equal to nailable roof insulation.

C. Install nailable roof insulation with long dimension parallel to roof rake with joints staggered. Fasten insulation with mechanical insulation fasteners.

D. Maintain minimum 1 inch wide clear opening between sheathing along full length of ridges.

E. Maintain minimum 1 inch wide clear opening between sheathing along upper one-half of hips. Install sheathing tight along lower one-half of hips.

F. Fasten insulation with mechanical insulation fasteners to meet uplift performance requirements. Arrange fasteners in uniform pattern to present a neat appearance on exposed to view surface of structural deck.

3.3 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not permit work to be damaged prior to covering insulation.

END OF SECTION 07 21 00

SECTION 072700

VAPOR PERMEABLE AIR BARRIER LIQUID MEMBRANE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the vapor permeable air barrier liquid membrane as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Vapor permeable/air barrier applied over sheathing board and cold formed metal framing.

2. Materials and installation to bridge and seal the following air leakage pathways and gaps:

a. Connections of the walls to the roof.
b. Connections of the walls to the foundations.
c. Seismic and expansion joints.
d. Openings and penetrations of window frames, storefront, curtain wall.
e. Door frames.
f. Piping, conduit, duct and similar penetrations.
g. Masonry ties, screws, bolts and similar penetrations.
h. All other air leakage pathways in the building envelope.

1.3 RELATED SECTIONS

A. Cold formed metal framing, including sheathing - Section 054000.

1.4 SUBMITTALS

A. Provide evidence to the Architect of licensing and certification under the Air Barrier Association of America's (ABAA's) Quality Assurance Program

B. Submit shop drawings showing locations and extent of air barrier and details of all typical conditions, intersections with other envelope systems and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated and how miscellaneous penetrations such as conduits, pipes electric boxes and the like are sealed.

C. Submit manufacturer's product data sheets for each type of membrane, including manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.

D. Submit manufacturer's data showing solids content of fluid applied membranes and coverage rates and wet film thickness upon application in order to achieve minimum dry film thickness required by this specification.

E. Submit manufacturer's installation instructions.

F. Submit certification by air barrier manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

G. Submit certification of compatibility by air barrier manufacturer, listing all materials on the project that it connects to or that come in contact with it, including sealant as specified in Section 054000 for caulking joints between sheathing panels.

H. Submit samples, 3 by 4 inch minimum size, of each air barrier material required for Project.

I. Test results of air permeability testing of primary air barrier material (ASTM E 2178-01)

J. Test results of assembly in accordance with ASTM E 2357.

K. Proof that the air barrier is part of an NFPA 285 approved wall assembly

1.5 PERFORMANCE REQUIREMENTS

A. Provide air barrier constructed to perform as a continuous air barrier, and as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration. Membrane shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air seal materials at such locations, changes in substrate and perimeter conditions.

B. Provide an air barrier assembly that has been tested in accordance with the Air Barrier Association of America's (ABAA's) approved testing protocol to provide air leakage results not to exceed:

1. 0.01 cfm/sf @ 1.57 psf as per ASTM E2357

C. NFPA 285 Compliance

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. The air barrier contractor shall be, during the bidding period as well as for the duration of the installation, officially recognized as a Licensed Contractor by the Air Barrier Association of America (ABAA). The contractor shall carry liability insurance and bonding.

2. Each worker who is installing air barriers must be either a Certified Applicator or an installer who is registered with ABAA.

3. Each Lead Certified Applicator can supervise a maximum of five registered installers. The Certified Applicator shall be thoroughly trained and experienced in th

installation of air barriers of the types being applied. Lead Certified Applicators shall perform or directly supervise all air barrier work on the project.

B. Single-Source Responsibility: Obtain air barrier materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

D. Field-Constructed Mock-Ups: Prior to installation of air barrier, apply air barrier as follows to verify details under shop drawing submittals and to demonstrate tie-ins with adjoining construction, and other termination conditions, as well as qualities of materials and execution:

1. Construct typical exterior wall panel, 8 feet long by 8 feet wide (one of CMU and one of sheathed areas, incorporating back-up wall, cladding, window and doorframe and sill, insulation, flashing, building corner condition, and typical penetrations and gaps; illustrating materials interface and seals.

E. Test mock-up in accordance with ASTM E 783 and ASTM E1105 for air and water infiltration.

F. Manufacturer shall be on-site at least once a week to observe installation and provide written report within 3 days.

G. Manufacturer shall confirm all termination details and compatibility with materials being terminated to.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer. Protect stored materials from direct sunlight.

C. Avoid spillage. Immediately notify Owner, Architect if spillage occurs and start clean up procedures.

D. Clean spills and leave area as it was prior to spill.

1.8 WARRANTY

A. System Warranty: Provide the manufacturer’s five (5) year material warranty, including the primary air barrier and installed accessory sealant and membrane materials..

PART 2 PRODUCTS

2.1 MATERIALS

A. Fluid-Applied Membrane: Henry Air-Bloc 17MR Vapor Permeable Fluid-Applied Membrane

or W.R. Grace Perm-A-Barrier VP or approved equal. Trade names used herein are those of the Henry Company

B. Transition Membrane: Blueskin SA or Blueskin VP 160

C. Window and Door Opening Flashing: Metal Clad

D. Liquid Applied Flashing: Henry Air-Bloc LF

E. Thru-Wall Flashing: Blueskin TWF

F. Primer: Blueskin LVC Adhesive.

G. Sealant: Henry HE 925 BES Sealant.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where the above grade waterproof membrane is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected to permit proper installation of the work.

3.2 SURFACE PREPARATION

A. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants.

B. Cracks in masonry and concrete up to 1/2" wide shall be filled with a trowel application of Liquid Applied Flashing or Sealant and allowed to skin over prior to application of the fluid-applied membrane to the surface. Alternatively, the cracks may be sealed with a strip of Transition Membrane applied to the substrate.

C. Joints in Sheathing up to 1/2” can be treated with Liquid Applied Flashing or Sealant.

D. Surfaces should be tied in with beams, columns, etc. using strips of Transition Membrane lapped a minimum of 3" on both substrates. Mechanical attachment should be made to all window and door frames, or a properly designed sealant joint provided.

3.3 TRANSITION MEMBRANE

A. Align and position self-adhering transition membrane, remove protective film and roll firmly into place with heavy roller. Ensure minimum 2" overlap at all ends and side laps.

B. Tie-in to window frames, metal door frames, etc., and at the interface of dissimilar materials as indicated on the Drawings.

C. Promptly roll all laps and membrane with a counter top roller to effect seal.

D. Ensure all preparatory work is complete prior to applying Liquid Applied Membrane

3.4 THRU-WALL FLASHING MEMBRANE

A. Ensure all preparatory work is complete prior to applying Thru-Wall Flashing.

B. Align and position the leading edge of Thru-Wall Flashing with the front horizontal edge of the foundation walls or shelf angles, partially remove protective film and roll membrane over surface and up vertically.

C. Roll firmly into place. Ensure minimum 2” overlap at all end and side laps.

D. Ensure through-wall flashing membrane extends fully to the exterior face of the exterior masonry veneer. Trim off excess as directed by the consultant.

E. Apply through-wall flashing membrane along the base of masonry veneer walls, over windows, doors and all other wall openings. Membrane shall form continuous flashing and shall extend up a minimum of 4-1/2" up the back-up wall.

F. When flashing at window openings, wrap the entire window opening with air barrier flashing membrane.

3.5 FLUID-APPLIED MEMBRANE APPLICATION

A. Apply fluid-applied membrane to wall substrates in a continuous coat at manufacturer’s recommended rate by spray or trowel to provide a minimum wet film thickness of 0.090" (90 mils) for rough surfaces like CMU and 0.070” (70 mils) for smooth sheathing.

1. Minimum dry film thickness shall be 0.048” (48 mils) on CMU and 0.037" (37 mils) on smooth sheathing.

B. Overlap liquid membrane on to transition membrane at connections a minimum of 1".

C. Apply fluid-applied membrane around masonry ties to ensure a complete seal.

D. Do not leave membrane exposed for any longer than 180 days.

E. Penetrations: Seal all penetrations with Liquid Applied Flashing or Sealant or other procedures in accordance with manufacturer’s instructions.

3.6 PROTECTING AND CLEANING

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Protect air barrier from exposure to the elements as required by the manufacturer.

D. Remove any masking materials after installation. Clean any stains on materials that would be exposed in the completed work using procedures as recommended by manufacturer.

1. Schedule work to ensure that the air and vapor barrier system is covered as soon as possible after installation. Protect air and vapor barrier system from damage during subsequent operations. If the air and vapor barrier system cannot be permanently covered within 180 days after installation, apply temporary UV

protection.

3.7 FIELD QUALITY CONTROL

A. Air Barrier Association of America Installer Audits: Cooperate with ABAA's testing agency. Allow access to work areas and staging. Notify ABAA in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Do not cover Work of this Section until testing and inspection is accepted. Arrange and pay for site inspections by ABAA to verify conformance with the material Manufacturer's instructions, the site Quality Assurance Program used by ABAA, and this section of the project specification.

1. Audits and subsequent testing shall be carried out at the following rate:

a. Up to 10,000 ft^2 of air barrier contract requires one (1) audit.
b. 10,001 – 35,000 ft^2 of air barrier contract requires two (2) audits.
c. 35,001 – 75,000 ft^2 of air barrier contract requires three (3) audits.
d. 75,001 - 125,000 ft^2 of air barrier contract requires four (4) audits.
e. 125,001 – 200,000 ft^2 of air barrier contract requires five (5) audits.
f. 200,001 ft^2 and over of air barrier contract requires six (6) audits.

2. Forward written audit reports to the Architect within 10 working days of the inspection and test being performed.

3. If the inspections reveal any defects, promptly remove and replace defective work at no additional cost to the Owner.

B. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.

2. Remove and replace deficient air-barrier components for retesting as specified above.

C. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

END OF SECTION

SECTION 075300 EPDM THERMOSET SINGLE-PLY ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. EPDM thermoset single-ply roofing.

B. Membrane flashings.

C. Metal flashings.

D. Roof insulation.

1.2 RELATED SECTIONS

A. Section 06 20 00 - Rough Carpentry.

B. Section 07 60 00 - Sheet Metal Flashing and Trim.

1.3 REFERENCES

A. American Society of Civil Engineers (ASCE) - ASCE 7 - Minimum Design Loads for Buildings and Other Structures, Current Revision.

B. ANSI/SPRI RP-4 "Wind Design Standard For Ballasted Single-ply Roofing Systems".

C. ANSI/SPRI WD-1 "Wind Design Standard for Roofing Assemblies".

D. ASTM International (ASTM):
1. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
2. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
3. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
4. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
5. ASTM D 816 - Standard Test Methods for Rubber Cements.
6. ASTM D 4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
7. ASTM D 4637 - Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane.
8. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

E. Factory Mutual (FM Global):
1. Approval Guide.
   a. Factory Mutual Standard 4470 - Approval Standard for Class 1 Roof Covers.
   b. Loss Prevention Data Sheets 1-28, 1-29.

F. International Code Council (ICC):
1. International Building Code (IBC).

G. National Roofing Contractors Association (NRCA) - Low Slope Roofing and Waterproofing Manual, Current Edition.

H. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.

I. Underwriters Laboratories (UL):
1. TGFU R1306 - "Roofing Systems and Materials Guide".
2. UL-790 - Standard Test Method for Fire Tests of Roof Coverings.

J. ANSI/ASHRAE/IESNA Standard 90.1 (2007): Energy Standard for Buildings Except Low-Rise Residential Buildings

1.4 DESIGN CRITERIA

A. Wind Uplift Performance:
1. Roof system is designed to withstand wind uplift forces as calculated using the current revision of ASCE-7.
2. Roof system is designed to achieve a FM 1-120 wind uplift rating.
3. Roof System is designed to achieve 120-psf of uplift testing.
4. Carlisle offers a standard 120 MPH wind speed warranty.

B. Fire Resistance Performance:
1. Roof system will achieve a UL Class A rating when tested in accordance with UL-790.

C. Thermal Performance: Roof system will achieve a minimum R value not less than 30.

D. Drainage: Provide a roof system with positive drainage where all standing water dissipates within 48 hours after precipitation ends.

E. Building Codes:
1. Roof system will meet the requirements of all federal, state and local code bodies having jurisdiction.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Detail Drawings:
1. Submit approved plan, section, elevation or isometric drawings which detail the appropriate methods for all flashing conditions found on the project.
2. Coordinate approved drawings with locations found on the Contract Drawings.

D. Selection Samples: For each finish product specified, two complete sets of chips representing manufacturer's full range of available colors, membranes, and thicknesses.

E. Verification Samples: For each finish product specified, two samples, minimum size 4 inches (100 mm) square representing actual product, color, and patterns.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: All products specified in this section will be supplied by a single manufacturer with a minimum of twenty (20) years experience.

B. Installer Qualifications:
   1. All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.
   2. Installer must be capable of extending the Manufacturer's Labor and Materials guarantee.
   3. Installer must be capable of extending the Manufacturer's No Dollar Limit guarantee.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Refer to Carlisle's Roofing System specification, Part II - Application, for General Job Site Considerations.

C. Safety Data Sheets (SDS) must be on location at all times during the transportation, storage and application of materials.

D. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.

E. When loading materials onto the roof, the Carlisle Authorized Roofing Applicator must comply with the requirements of the building owner to prevent overloading and possible disturbance to the building structure.

F. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.

G. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.

H. Provide protection, such as 3/4 inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.

I. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.

J. New roofing shall be complete and weathertight at the end of the work day.

K. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

1.9 WARRANTY

A. At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's Total-System warranty, outlining its terms, conditions, and exclusions from coverage.
1. 30 years. (Basis of Design)
2. Coverage to be extended to include accidental punctures in accordance with terms stated in the Warranty document.
3. Coverage to be extended to include damage caused by a maximum 2 inch (51 mm) diameter hail in accordance with terms stated in the Warranty document.
4. Coverage to be extended to include roof edge metal water tightness in accordance with terms stated in the Warranty document.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Carlisle SynTec Systems, which is located at: P. O. Box 7000; Carlisle, PA 17013; ASD Toll Free Tel: ; 800-4-SYNTEC; Tel: ; 717-245-7000; Fax: ; 717-245-7053; Email:info@carlislesyntec.com; Web:https://www.carlislesyntec.com.
1. Or Equals:
a. Firestone
b. JM
c. And or approved equal

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.2 SCOPE / APPLICATION

A. Roof System: Provide a waterproof roof system, capable of withstanding uplift forces as specified in Design Criteria.

B. Base Flashing: Provide a waterproof, fully adhered base flashing system at all penetrations, plane transitions and terminations.

C. Insulation: Provide a roof insulation system beneath the finish membrane.

2.3 MEMBRANE BASE SHEET

A. Carlisle SureMB 120TG Base Sheet: A smooth-surfaced, torch-grade SBS base ply, reinforced with a non-woven polyester mat that is saturated and coated with asphaltic bitumen and SBS elastomers.

B. VapAir Seal 725TR Air/Vapor Barrier: A 40-mil composite consisting of 35-mils of self-adhering rubberized asphalt laminated to a 5-mil woven polypropylene film.

C. VapAir Seal MD Air/Vapor Barrier: reinforced composite aluminum foil with self-adhesive SBS backing and removable poly release film. Used for direct application over metal decks.

2.4 INSULATION

A. Polyisocyanurate InsulBase: Carlisle InsulBase. Rigid board with glass fiber reinforced facers (GRF) on both sides, meeting or exceeding the requirements of ASTM C 1289, Type II, Class 1.
   1. Compressive Strength: Grade 2 (20 psi) (138 kPa).
   2. Density: 2 lb per cubic foot (24 kg/cu m) minimum.

B. SecurShield Polyiso: Rigid board with coated glass fiber mat facers (CGF) on both sides, meeting or exceeding the requirements of ASTM C 1289, Type II, Class 2.
   1. Compressive Strength: Grade 2 (20 psi) (138 kPa).
   2. Density: 2 lb per cubic foot (24 kg/cu m) minimum.

C. Composite Board: Composite insulation panel comprised of 1/2 inch (13 mm) high-density Polyiso cover board laminated during the manufacturing process to SecurShield rigid Polyiso roof insulation meeting ASTM C1289. Carlisle SecurShield HD Composite.
   1. Top Layer: ASTM C1289 Type II, Class 4, Grade 1.
   2. Compressive Strength: 80 psi min. (751 kPa)
   3. Board Thickness: 1/2 inch (13 mm)
   4. Bottom Layer: ASTM C1289 Type II, Class 2
   5. Compressive Strength: Grade 2 (20 psi) (138 kPa).

D. Water-resistant and silicone treated gypsum panel with embedded fiberglass facer on both sides, and pre-primed on one side. GP Gypsum Dens-Deck Prime, distributed by Carlisle.
   1. Board Thickness: 5/8 inch (15 mm).

E. Moisture-, mold- and impact-resistant, nonstructural fiber-reinforced gypsum panel made from 95 percent recycled materials. Securock, distributed by Carlisle.
   1. Board Thickness: 5/8 inch (15 mm).

F. SecurShield HD Plus Polyiso Cover board: Rigid board with coated glass fiber mat facers (CGF) on both sides, meeting or exceeding the requirements of ASTM C 1289, Type II, Class 4, Grade 1. Designed for higher uplift with fewer fasteners per board.
   1. Compressive Strength: 80 psi min. (751 kPa).
   2. Board Thickness: 1/2 inch (13 mm).

2.5 INSULATION ADHESIVE

A. Flexible FAST Adhesive: A spray or extruded applied, two-component polyurethane, low-rise expanding foam adhesive used for attaching approved insulations to compatible substrates (concrete, cellular lightweight insulating concrete, gypsum, cementitious wood fiber, wood or steel) or existing smooth or gravel surfaced BUR, modified bitumen or cap sheets.

B. Flexible FAST Dual Cartridge Adhesive: A two-component, polyurethane construction grade, low-rise expanding adhesive designed for bonding insulation to various substrates using a portable applicator.

C. Flexible FAST Dual Tank Adhesive: A two-component, polyurethane construction grade, low-rise expanding adhesive designed for bonding insulation to various substrates using a portable applicator.

D. Flexible FAST 5 gallon Jug Adhesive: A two-component, polyurethane construction grade, low-rise expanding adhesive designed for bonding insulation to various substrates, packaged for use with spray application rigs.

2.6 ETHYLENE, PROPYLENE, DIENE TERPOLYMER (EPDM) MEMBRANE

A. Sure-Seal Non-Reinforced Membrane: Cured, non-reinforced EPDM membrane meeting the requirements of ASTM D 4637 Type I.
   1. Attachment Method: Fully adhered.
   2. Color: Black.
   3. Membrane Thickness: 90 mil nominal.
   4. Sheet Dimensions:
      a. Width: 10 feet (3.05 m) maximum.
      b. Length: 100 feet (30.5 m) maximum.
   5. Performance:
      a. Tensile Strength: 1550 psi (10.7 MPa) minimum.
      b. Tear Resistance: 200 lbf/in (35 kN/m) minimum.
      c. Elongation: 480 percent.

B. Sure-Seal Non-Reinforced Membrane: Cured, non-reinforced EPDM membrane meeting the requirements of ASTM D 4637 Type I.
   1. Attachment Method: Fully adhered.
   2. Color: Black.
   3. Membrane Thickness: 60 mil nominal.
   4. Sheet Dimensions:
      a. Width: 10 feet (3.05 m) maximum.
      b. Length: 100 feet (30.5 m) maximum.
   5. Performance:
      a. Tensile Strength: 1550 psi (10.7 MPa) minimum.
      b. Tear Resistance: 200 lbf/in (35 kN/m) minimum.
      c. Elongation: 480 percent.

2.7 FLASHING ACCESSORIES

A. Sure-Seal (black) Pressure-Sensitive Pipe Seals with Factory-Applied TAPE on the deck flange are available for use with Sure-Seal Roofing systems.

B. Sure-Seal-Sensitive Pourable Sealer Pocket: Pre-fabricated Pourable Sealer Pocket consisting of a 2 inch (51 mm) wide plastic support strip with Pressure-Sensitive, Factory-Applied, adhesive backed uncured Elastoform Flashing.

C. Sure-Seal Pressure-Sensitive (PS) Inside/Outside Corner: A 7 inch by 9 inch precut 60-mil thick Elastoform Flashing with a 30-mil Factory-Applied TAPE.

D. Sure-Seal Pressure-Sensitive (PS) Curb Flashing - A 60-mil thick, 20 inch (508 mm) wide cured EPDM membrane with 5 inch (126 mm) wide Factory-Applied Pressure-Sensitive TAPE along one edge to be used to flash curbs/skylights, etc.

E. Sure-Seal 20" pressure-Sensitive Cured Flashing - A 20" wide (508 mm) cured EPDM membrane with Pressure-Sensitive TAPE the full width, factory applied, used to flash curbs/skylights, etc.

F. Sure-Seal Pressure-Sensitive Cured Cover Strip: Sure-Seal or Sure-White 60-mil cured EPDM membrane laminated to a nominal 35-mil cured Factory-Applied TAPE.

G. Sure-Seal Pressure-Sensitive "T" Joint Covers: A factory cut uncured 60-mil thick EPDM flashing laminated to a nominal 35-mil Factory-Applied TAPE, used to overlay field splice

intersections and to cover field splices at angle changes. Available in 6 inch by 6 inch and 12 inch by 12 inch for Sure-Seal applications, and 6 inch by 6 inch for Sure-White applications.

H. Sure-Seal Pressure-Sensitive Elastoform Flashing: 60-mil thick uncured EPDM Flashing laminated to a 30-mil Factory-Applied Pressure-Sensitive TAPE used in conjunction with Sure-Seal Primer.

I. Sure-Seal Pressure-Sensitive RUSS (Reinforced Universal Securement Strip):
1. 9 inch (228 mm) RUSS: A nominal 9 inch (228 mm) wide, 45-mil thick reinforced EPDM membrane with a nominal 3 inch (76 mm) wide 30-mil thick cured synthetic rubber pressure-sensitive adhesive laminated to both edges. This product is used in place of narrow sheets to secure the membrane in the perimeter roof area. The use of this product allows field membrane to be utilized over the entire roof area.

2.8 CLEANERS, PRIMERS, ADHESIVES AND SEALANTS

A. Carlisle Weathered Membrane Cleaner: Clear, solvent-based cleaner used to loosen and remove contaminants from the surface of exposed EPDM membrane prior to applying EPDM Primer.

B. Sure-Seal SecurTAPE: 3 inch (76 mm) or 6 inch (152 mm) wide by 100 foot (30.5 M) long splice tape used for splicing adjoining sections of EPDM membrane.

C. Low VOC EPDM and TPO Primer - A low VOC (volatile organic compound) primer (less than 250 grams/liter) for use with SecurTAPE or Pressure-Sensitive products.

D. Sure-Seal Lap Sealant: A heavy-bodied material (trowel or gun-consistency) used to seal the exposed edges of a membrane splice.
1. Sure-Seal Lap Sealant: Black sealant for use with Sure-Seal (black) Roofing Systems.

E. EPDM x-23 Low-VOC Bonding Adhesive: A Low-VOC (volatile organic compound) bonding adhesive (less than 250 grams/liter) used for bonding Sure-Seal/Sure-White EPDM membranes to various surfaces.

F. Low-VOC Bonding Adhesive: A Low-VOC (volatile organic compound) bonding adhesive (less than 250 grams/liter) used for bonding Sure-Seal/Sure-White EPDM membranes to various surfaces.

G. Flexible FAST Adhesive: A spray or extruded applied, two-component, polyurethane, low-rise expanding foam adhesive used to securely bond FleeceBACK membranes to a variety of substrates.

H. Flexible FAST Dual Cartridge Adhesive: A two-component, polyurethane construction grade, low-rise expanding adhesive used to securely bond FleeceBACK membranes to a variety of substrates. The adhesive is extrusion applied 4 inch (102 mm), 6 inch (152 mm) or 12 inch (305 mm) on center (depending on project conditions) using a portable applicator.

I. Flexible FAST Dual Tank Adhesive: A spray applied, two-component, polyurethane construction grade, low-rise expanding adhesive used to securely bond FleeceBACK membranes to a variety of substrates.

J. Flexible FAST 5-gallon Jug Adhesive: A two-component, polyurethane construction grade, low-rise expanding adhesive designed for bonding insulation to various substrates, packaged for use with low pressure urethane equipment.

K. Water Cut-Off Mastic: A one-component, low viscosity, self wetting, Butyl blend mastic used as a compression sealing agent between EPDM membranes and applicable substrates.

L. Sure-Seal One-Part Pourable Sealer: A one-component, moisture curing, elastomeric polyether sealant used as a sealant around hard-to-flash penetrations such as clusters of pipes, and is available in white or black.

M. Universal Single-Ply Sealant: A 100 percent solids, solvent free, one-part, polyether sealant that provides a weather tight sealant to a variety of building substrates; used as a termination bar sealant. Available in white only.

N. CAV-GRIP III Low-VOC Aerosol Contact Adhesive/Primer: a low-VOC, methylene chloride-free adhesive that can be used for a variety of applications including: Priming unexposed asphalt prior to applying Flexible FAST Adhesive, adhering Sure-Seal EPDM, horizontally, for the field of the roof, and for adhering Sure-Seal FleeceBACK and Sure-Seal EPDM membrane to vertical walls. Coverage rate is approximately 2,000-2,500 sq. ft. per 40 lb cylinder and 4,000-5,000 sq. ft. per 85 lb cylinder as a primer, in a single-sided application and 750 sq. ft. per 40 lb cylinder and 1,500 sq. ft. per 85 lb cylinder as an adhesive for vertical walls, in a double-sided application; 1,000 sq. ft. per 40 lb cylinder and 2,000 sq. ft. per 85 lb cylinder as an adhesive, horizontally, for the field of the roof, in a double-sided application.

2.9 FASTENING COMPONENTS

A. HP Fastener: Threaded, black epoxy electro-deposition coated (E-Coat) fastener for use with steel, wood plank or oriented strand board (OSB).

B. InsulFast Fasteners: Threaded, #12 fastener with #3 Phillips head used with 3 inch (76 mm) diameter Insulation Plates. For insulation attachment into steel or wood decks.

C. Pre-Assembled ASAP Fasteners: InsulFast Fastener and pre-assembled 3 inch (76 mm) diameter Plastic Insulation Plate for insulation attachment on adhered and mechanically-fastened roofing systems.

D. CD-10 Concrete Fastener: A hammer-driven, non-threaded, black epoxy electro-deposition coated (E-Coat) fastener for use with structural concrete decks rated 3,000 psi or greater.

E. HD 14-10 Concrete Fastener: A #14 threaded fastener used for minimum 3,000 psi concrete decks.

F. Lite-Deck Fastener: An oversized diameter metal fastener and associated 3 inch diameter Lite-Deck metal plate for use on adhered roofing systems to attach insulation to dense gypsum decks, cementitious wood fiber and lightweight insulating concrete.

G. Seam Fastening Plate: 2 inch (51 mm) diameter metal plate for insulation, membrane and RUSS attachment.

H. Insulation Fastening Plate: Nominal 3 inch (76 mm) diameter FM approved metal plate used for insulation attachment.

I. Sure-Seal Metal Fastening Bar: 1 inch by 10 foot long (25 mm x 3048 mm) Galvalume-coated steel fastening bar pre-punched 6 inches (152 mm) on center for membrane securement on Mechanically Fastened Roofing Systems.

2.10 EDGINGS AND TERMINATIONS

A. SecurEdge 200: A snap-on edge system consisting of a 24 gauge galvanized metal water dam. Finish as noted on the Finish Schedule of the Contract Drawings.

B. SecurEdge 300: A 24 gauge galvanized metal water dam. Finish as noted on the Finish Schedule of the Contract Drawings.

C. SecurEdge 2000: An anchor bar roof edge fascia system consisting of 0.100 inch (2.5 mm) thick extruded aluminum bar, corrosion resistant stainless steel fasteners and snap-on fascia cover.

D. SecurEdge 3000: A metal anchor bar fascia system consisting of a 20 gauge steel retainer bar, corrosion resistant fasteners and aluminum or 24 gauge steel snap-on fascia cover.

E. Sure-Seal Drip Edge: A 22 gauge pre-punched 90-degree angle cleat and 12 foot (3658 mm) long fascia sections. Kynar 500 or aluminum finish as noted on the Finish Schedule of the Contract Drawings.

F. SecurEdge 200 Coping: An anchor cleat with pre-slotted holes, a concealed joint cover, and 10 or 12 foot sections of coping cap. Kynar 500 finish as noted on the Finish Schedule of the Contract Drawings.

G. SecurEdge 300 Coping: An anchor cleat with pre-slotted holes, a concealed joint cover, and 10 or 12 foot sections of coping cap. Kynar 500 finish as noted on the Finish Schedule of the Contract Drawings.

H. Sure-Seal Termination Bar: 1 inch (13 mm) wide, .098 inch (2.5 mm) thick extruded aluminum bar pre-punched 6 inches (152 mm) on center with sealant ledge to support Lap Sealant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Do not commence work until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment.

D. A vapor retarder / temporary roof (Carlisle VapAir Seal 725TR Air & Vapor Barrier/Temporary Roof or Carlisle VapAir Seal MD Air & Vapor Barrier) may be applied to protect the inside of the structure prior to the roof system installation.

3.3 INSULATION - SYSTEM DESIGN

A. Base Layer:
   1. Type: Carlisle SecurShield Poly ISO.

2. Thickness: 1 1/2 inches.
3. Attachment Method: Flex Fast Adhesive. (4-inch Beads)

B. Top Layer:
1. Type: Carlisle SecurShield HD Composite.
2. Thickness: 2 inches.
3. Attachment Method: Flex Fast Adhesive. (4-inch Beads)

C. Tapered System:
1. Type: Carlisle Tapered SecurShield Poly ISO.
2. Field Slope: 1/4 inch per foot.
3. Sump Slope: 1/2 inch per foot.
4. Cricket Slope: 1/2 inch per foot.
5. Attachment Method: Flex Fast Adhesive. (4-inch Beads)

3.4 INSULATION PLACEMENT

A. Install insulation or membrane underlayment in multiple layers over the substrate with boards butted tightly together with no joints or gaps greater than 1/4 inch (6 mm). Stagger joints both horizontally and vertically.

B. Secure insulation to the substrate with the required mechanical fasteners or insulation adhesive in accordance with the manufacturer's current application guidelines.

C. Do not install wet, damaged or warped insulation boards.

D. Stagger joints in one direction unless joints are to be taped. Install insulation boards snug. Gaps between board joints shall not exceed 1/4 inch (6 mm). Fill all gaps in excess of 1/4 inch (6 mm) with same insulation material.

E. Wood nailers must be at least 3 1/2 inches (89 mm) wide or 1 inch (25 mm) wider than adjacent metal flange. Thickness must equal that of insulation but not less than 1 inch (25 mm) thickness.

F. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.

G. Do not install any more insulation than will be completely waterproofed each day.

3.5 INSULATION ATTACHMENT

A. Install insulation layers, maximum 4 feet by 4 feet (1220 mm by 1220 mm), applied with adhesive, coverage rate as necessary to achieve the specified attachment and uplift rating. Press each board firmly into place after adhesive develops strings when touched, typically 1-1/2 to 2 minutes after adhesive was applied, and roll with a weighted roller. Add temporary weight and use relief cuts to ensure boards are well adhered. Stagger the joints of additional layers by a minimum of 6 inches (152 mm).

3.6 MEMBRANE PLACEMENT AND ATTACHMENT (Fully Adhered)

A. Unroll and position membrane without stretching. Allow the membrane to relax for approximately 1/2 hour before bonding. Fold the sheet back onto itself so half the underside of the membrane is exposed.

B. Apply the Bonding Adhesive in accordance with the manufacturer's published instructions, to both the underside of the membrane and the substrate. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.

C. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded half of the membrane sheet with a soft bristle push broom to achieve maximum contact.

D. Fold back the unbonded half of the membrane sheet and repeat the bonding procedure.

E. Install adjoining membrane sheets in the same manner, overlapping edges appropriately to provide for the minimum splice width. It is recommended that all splices be shingled to avoid bucking of water.

3.7 MEMBRANE SPLICING (Tape Splice)

A. Overlap adjacent sheets and mark a line 1/2 inch out from the top sheet.

B. Fold the top sheet back and clean the dry splice area (minimum 2 1/2 inches (64 mm wide) of both membrane sheets with Sure-Seal Primer as required by the membrane manufacturer.

C. Where Splice Tape is not Factory-Applied, apply Splice Tape to bottom sheet with the edge of the release film along the marked line. Press tape onto the sheet using hand pressure. Overlap tape roll ends a minimum of 1 inch (13 mm).

D. Remove the release film and press the top sheet onto the tape using hand pressure.

E. Roll the seam toward the splice edge with a 2 inch (51 mm) wide steel roller.

F. Install Pressure-Sensitive "T" Joint Cover, a 6 inch wide (152 mm) section of Pressure-Sensitive Elastoform Flashing over all field splice intersections.

G. When using non-Pressure-Sensitive Elastoform Flashing or Elastoform Flashing, seal edges of flashing with Lap Sealant.

H. The use of Lap Sealant with tape splices is optional except at tape overlaps and cut edges of reinforced membrane where Lap Sealant is required.

3.8 FLASHING

A. Wall and curb flashing shall be cured EPDM membrane. Continue the deck membrane as wall flashing where practicable.

B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

3.9 WALKWAYS

A. Install walkways at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, etc.) and all locations as identified on the Contract Drawings.

B. Adhere walkways pads to the EPDM membrane in accordance with the manufacturer's current application guidelines.

3.10 DAILY SEALS

A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.

B. Use Sure-Seal Pourable Sealer or other acceptable membrane seal in accordance with the manufacturer's requirements.

3.11 CLEAN UP

A. Perform daily clean-up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.

B. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

3.12 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 59 10 - RE-ROOFING PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes removal of existing roofing system in preparation for new roof system, as indicated on architectural drawings.

B. Related Sections:
1. Section 07 53 00 – EPDM Roofing
2. Section 07 60 00 – Sheet Metal Flashing & Trim

1.2 SYSTEM DESCRIPTION

A. Roof Areas as Indicate: Remove complete existing roof system including the roof plies, roof membranes, metal roof system trim, drains, scuppers, gutters, downspouts, metal edge systems, metal coping cap systems, insulation and associated materials down to the roof deck, perimeter structure and roof penetrations prior to installing the new roof system. Remove and replace damaged roof deck.

B. Remove roof mounted equipment as required to install new roof, membrane and curbs. Replace as required.

1.3 SUBMITTALS

A. Field Reports: Indicate results of deck quality and fastener pullout tests to be submitted to owner’s representative.

B. Fastener pullout test reports for the individual roof deck types.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with industry standards.

1.5 QUALIFICATIONS

A. Materials Removal Firm: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 PRE-INSTALLATION MEETINGS

A. Convene a minimum two weeks prior to commencing work of this section.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not remove existing roofing membrane when weather conditions threaten integrity of building contents or intended continued occupancy.

C. Maintain continuous temporary protection prior to and during installation of new roofing system to keep building weather tight.

1.8 SCHEDULING

A. Schedule Work to coincide with commencement of installation of new roofing system.

1.9 COORDINATION

A. Remove only existing roofing materials being replaced with new materials, as weather will permit.

B. Coordinate Work with other affected mechanical and electrical work associated with roof penetrations.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Temporary Protection: Sheet polyethylene or fiber reinforced plastic; furnish weights to retain sheeting in position.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing roof surface is clear and ready for work of this section.

B. Perform pullout testing on all lightweight insulating concrete on metal form decks cementitious using the specified insulation fastener to confirm the required pullout values as specified in the “EPDM Roofing” specification.

3.2 PREPARATION

A. Remove complete existing roof system including the roof plies, insulation and associated materials down to the roof deck, perimeter structure and roof penetrations prior to installing the new roof system.

B. Sweep roof surface clean of loose matter.

C. Remove loose refuse and dispose off site in a manner compliant with all local, state and federal laws / regulations for waste disposal.

D. Ensure existing substrate is sloped, and/or level and plumb, as per the project documents prior to the laying of new insulation.

3.3 EXISTING CONSTRUCTION

A. Remove metal counter flashings and trim.

B. Remove existing roofing system(s), perimeter trim and base flashings, flashings around roof protrusions, drains, scuppers, gutters, downspouts, metal edge systems, metal coping cap systems, pitch pans and pockets, insulation vents, metal flashings, step flashings, etc. as necessary.

C. Remove damaged deck materials.

D. Remove inadequate or damaged curbing.

E. Replace removed deck surface with new deck surfacing to match existing where required.

F. Replace removed curbing w/ new curbing where required.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution Requirements: Protecting installed construction.

B. Install temporary protective sheeting over uncovered deck surfaces.

C. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.

D. Provide for surface drainage from sheeting to existing and new drainage facilities.

E. Do not permit traffic over unprotected or repaired deck surface.

END OF SECTION 07 59 10

SECTION 07 60 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the sheet metal work as indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. Downspouts
2. Scuppers
3. Surface mounted wall counterflashings

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (galvanized) or Zinc-Iron Alloy-Coated (galvannealed) by the Hot-Dip Process.
2. ASTM A792 Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process.
3. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
5. ASTM D692 Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
6. ASTM B32 Solder Metal
7. ASTM B486 Paste Solder

B. Underwriters Laboratories (UL)

C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

1. 1993 Edition Architectural Sheet Metal Manual

D. National Roofing Contractors Association (NRCA)

1. Roofing and Waterproofing Manual

E. American Society of Civil Engineers (ASCE)

1. ASCE 7-16 Minimum Design Loads for Buildings and Other Structures.

F. FS QQ-L-201 - Specification for Lead Sheet

G. FS O-F-506 - Flux, Soldering, Paste and Liquid

1.4 SUBMITTALS

A. Submit under provisions of this specification.

B. Product Data: Provide manufacturer's specification data sheets for each product.

C. Submit two samples, 12 x 12 inch in size illustrating typical external corner, internal corner, valley, junction to vertical dissimilar surface, material and finish.

D. Shop Drawings

1. For manufactured and ANSI/SPRI approved pre-manufactured metal edge fascia, pre-manufactured metal coping caps and metal fascia extenders, and all other sheet metal fabrications.

2. Shop drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashing, termination's, and installation details.

3. Indicate type, gauge and finish of metal.

E. Sample Warranty

1. Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the Owner. Warranty shall be provided from one manufacturer and part of a total Edge-to-Edge roof warranty that includes the EPDM roof system, pre-manufactured metal coping cap system, pre-manufactured metal edge system, and flashing systems.

F. Certification

1. Submit roof manufacturer's certification that metal fasteners furnished are acceptable to roof manufacturer.

G. Manufacturer's Product Data

1. Metal material characteristics and installation recommendations.

2. Submit color chart prior to material ordering and/or fabrication so that equivalent colors to those specified can be approved.

1.5 QUALITY ASSURANCE

A. Reference Standards

1. Comply with details and recommendations of SMACNA Manual for workmanship, methods of joining, anchorage, provisions for expansion, etc.

B. If required, fabricator/installer shall submit work experience and evidence of adequate financial Responsibility. The owner's representative reserves the right to inspect fabrication facilities in determining qualifications.

C. Successful contractor must obtain all components of roof system from a single manufacturer including any roll good materials if required. Any secondary products that are required, which cannot be supplied by the specified manufacturer, must be recommended and approved in writing by primary manufacturer prior to bid submittal.

D. Manufacturer shall have in place a documented, standardized method for maintaining quality control such as ISO-9001 approval.

E. The roof material manufacturer shall conduct all required periodic inspections of work in progress as described herein and shall furnish written documentation of all such inspections.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible.

B. Stack pre-formed and pre-finished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials which may cause discoloration or staining.

1.7 JOB CONDITIONS

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for pre-formed metal roofing system.

B. Protection:

1. Provide protection or avoid traffic on completed roof surfaces.

2. Do not overload roof with stored materials.

3. Support no roof-mounted equipment directly on the roofing system.

C. Ascertain that work of other trades which penetrates the roof or is to be made watertight by the roof, is in place and approved prior to installation of roofing.

1.8 DESIGN AND PERFORMANCE CRITERIA

A. ANSI/SPRI ES-1 (Pre-manufactured Metal Coping Cap System and Pre-manufactured Metal Edge Fascia System)

1. ANSI/SPRI ES-1 test reports must be submitted for specific project wind uplift requirements per Section 1.16 Design and Performance Criteria within EPDM specification.

B. Thermal expansion and contraction:

1. Completed metal edge fascia and extruded anchor bar system shall be capable of withstanding unlimited thermal expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.

1.9 WARRANTIES

A. Material Manufacturer's Warranty

1. Pre-finished metal material shall require a written 20-year non-prorated warranty covering fade, chalking and film integrity. The material shall not show a color change greater than 5 NBS color units per ASTM D-2244 or chalking excess of 8 units per ASTM D-659. If either occurs material shall be replaced per warranty, at no cost to the Owner.

2. Warranty shall be an Edge-to-Edge roof warranty provided by one manufacturer, and shall include the EPDM roof system, pre-manufactured metal coping cap system, pre-manufactured metal edge fascia system, flashings, and the transition between all systems.

3. Provide a manufacturer’s Edge-to-Edge roof warranty. The manufacturer will also furnish their standard decorative finish warranty.

4. At the request of the Owner, the Manufacturer will provide an annual inspection. The request for annual inspections shall be applicable for the life of the warranty.

B. Contractor's Warranty

1. The Contractor shall provide the Owner with a notarized written warranty assuring that all sheet metal work including caulking and fasteners to be

watertight and secure for a period of three (3) years from the date of final acceptance of the building. Warranty shall include all materials and workmanship required to repair any leaks that develop.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Two Piece counterflashing systems shall be the two-piece type factory formed system and shall consist of a two-piece Type 300 Series chrome-nickel soft temer stainless steel. Units and type, material, and profile indicated, formed to provide secure interlocking of separate receiver and counterflashing pieces, and compatible with flashing indicated:

1. Material: Stainless steel, 0.0187 inch thick.

2. Surface Mounted Type: Provide with 45-degree caulk cup above fastening flange.

3. Stucco Type: Provide with upturned fastening flange of 4" minimum, and extension leg of length to match thickness of applied finish materials or a minimum of 4".

4. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

5. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

6. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.

Receiver shall have a special vertical locking slot that requires no malleting or bending to the cap insert member in place.

Cap insert members shall be Type 300 Series soft temper astentic stainless steel 0.018" thick, factory formed to snap lock into vertical locking slot on the receiver portion and provide spring action against the roof flashing system.

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Keystone Flashing Company
2. Fry Reglet Corporation
3. Cheney Flashing Company

B. Miscellaneous Metals and Flashings:

1. Downspouts: Kynar finished aluminum, 0.050-inch-thick with 2” wide x 0.050-inch double folded hold down straps at 5’ on center secured to the building exterior wall.
2. Pre-Manufactured cap system, Kynar finished aluminum, 0.050 inch thick.
3. Escutcheon Plates: Kynar finished Aluminum, 0.040 inch thick.
4. Curb to Wall Metal Expansion Joints: Mill finished Aluminum; 0.050 inch thick.
5. Curb to Curb Metal Expansion Joints: Mill finished Aluminum; 0.050 inch thick.
6. Surface Mounted Counterflashings: Kynar finished Aluminum, 0.050 inch thick.
7. Copper Metal Flashings: 20 oz. copper.
8. Equipment Slip Flashing: Mill finished Aluminum, 0.040 inch thick.
9. Equipment Support Flashing: Mill finished Aluminum, 0.040 inch thick.
10. Solder for Stainless Steel: ASTM B 32, Grade Sn60, used with an acid flux of type recommended by stainless-steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.
11. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
12. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened. Exposed fasteners shall have a neoprene or other suitable weatherproofing washer.
13. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coat.
14. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
15. Sealing Tape: Pressure sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

16. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.

17. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

18. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.

19. Zinc-Coated Steel Sheet: ASTM A526, 0.20% copper, 26 gauges (0.0179"); designation G90 hot-dip galvanized, mill phosphatized.

20. Stainless Steel Sheet: Type 302/304, ASTM A167, 26-gauge, (0.0217"), annealed except dead soft where fully concealed by other work, 2D (dull) finish.

21. Copper Sheet: ASTM B370, 20 oz., temper HOO (cold-rolled).

22. Lead-Coated Copper Sheet: ASTM B101. Type I, Class A (12-15 1 lb. of lead coating per 100 sq. ft.), 17.1 oz. (0.022").

23. Zinc Alloy Sheet: Zinc with 0.6% copper and 0.14% titanium; 0.27" thick (21 gauge); standard (soft) temper, mil finish.

2.2 RELATED MATERIALS

A. Metal Primer: Zinc chromate type.

B. Plastic Cement: ASTM D 4586

C. Sealant: As required by material manufacturer.

D. Lead: Meets Federal Specification QQ-L-201, Grade B, four (4) pounds per square foot.

E. Solder: ANSI/ASTM B32; 95/05 type.

F. Flux: FS O-F-506.

G. Underlayment: Ply of specified base flashing EPDM or approved equal.

H. Fasteners:

1. Nails and Fasteners: Non-ferrous metal or hot dipped galvanized fasteners complying with ASTM A153 and connectors complying with ASTM A653, Class G185; Type 304 or Type 316 stainless steel fasteners and connectors shall be used with new generation of pressure-treated wood; except that hard copper

nails shall be used with copper; aluminum or stainless steel nails shall be used with aluminum; and stainless steel nails shall be used with stainless steel. Fasteners shall be self-clinching type of penetrating type as recommended by the manufacturer of the wood blocking/nailer material. Nails and fasteners shall be flush-driven through flat metal discs of not less than one (1) inch diameter. Omit metal discs when one-piece composite nails or fasteners with heads not less than one (1) inch diameter are used.

2. Fastening shall conform to ANSI/SPRI ES-1 requirements, SMACNA, or as stated on section details, whichever is more stringent and per the manufacturer's requirements.

I. Metal Termination Bars:

1. Shall be heavy flat bar aluminum unless otherwise recommended by membrane manufacturers.

2. Material shall be .125" x 1" (minimum) aluminum conforming to ASTM B-221, mill finish. Bars shall have holes for fasteners at 6" o.c. maximum.

PART 3 - EXECUTION

3.1 PROTECTION

A. Isolate contact areas of dissimilar metals with heavy asphalt or other approved coating, specifically made to stop electrolytic action.

3.2 GENERAL

A. Install work watertight, without waves, warps, buckles, fastening stress, or distortion, allowing for expansion and contraction.

B. Fastening of metal to walls and wood blocking shall comply with ANSI-SPRI ES-1, SMACNA Architectural Sheet Metal Manual and/or manufacturer's recommendations whichever is of the highest standard.

C. All accessories or other items essential to the completeness of sheet metal installation, whether specifically indicated or not, shall be provided and of the same material as item to which applied.

3.3 INSPECTION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets are in place, and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed, and secure.

C. Beginning of installation means acceptance of existing conditions.

D. Field measure site conditions prior to fabricating work.

3.4 SHOP FABRICATED SHEET METAL

A. Installing Contractor shall be responsible for determining if the sheet metal systems are in general conformance with roof manufacturer's recommendations.

B. Metal work shall be shop fabricated to configurations and forms in accordance with recognized sheet metal practices.

C. Hem exposed edges.

D. Angle bottom edges of exposed vertical surfaces to form drip.

E. All corners for sheet metal shall be lapped with adjoining pieces fastened and set in sealant.

F. All corner/miter anchor bars for the pre-manfuctured metal edge system shall be installed prior to straight length anchor bars. All anchor bars shall be set in two (2) ¼" wide beads of the specified sealant, and with adjoining pieces fastened together with splices. Joints for the anchor bars shall be formed with a ¼" opening between sections.

G. Joints for counterflashings shall be overlapped a minimum of 3", and counterflashings shall extend 4" below the roof flashing termination bar.

H. Install sheet metal to comply with ANSI/SPRI, SMACNA and NRCA standards, and per the manufacturer's instructions.

3.5 FLASHING MEMBRANE INSTALLATION

A. EQUIPMENT SUPPORTS/EXHAUST VENTS

1. Mill finished aluminum counterflashing and/or slip flashing extender shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match.

2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.

3. On small units, install an 0.040 mill finished aluminum extender will be installed under the existing counterflashing or curb lip to cover the newly installed roof flashing system by at least 4 inches. The new extender will be secured with fasteners and neoprene washers every 8 inches on center.

B. CURB DETAIL/AIR HANDLING STATION

1. Mill finish aluminum slip flashing extender shall be provided with watertight accessories such as miters, transitions, end caps, etc. and finished to match.

2. Accessories: Joint covers, corners, fasteners, strip flashing at joinings, fastening, and other accessories shall be included.

3. Over the termination bar, an 0.040 mill finished aluminum extender will be installed under the existing counterflashing or curb lip to cover the newly installed roof flashing system by at least 4 inches. New counterflashing will be secured with fasteners and neoprene washers every 8 inches on center.

C. SURFACE MOUNTED COUNTERFLASHINGS

1. Install specified roof flashing system with both plies terminating at the top of the specified flashing height. Secure continuous termination bar through top of flashing system and into wall at a maximum of 6” o.c. Caulk top of the termination bar and roof flashing system with a three-course application of asphaltic mastic and reinforcing mesh, or the specified elastomeric asphaltic sealant to provide a watertight seal.

2. Install new surface mounted counterflashing receiver and secure with neoprene gasketed fasteners at eight (8) inches on center. Seal top of counterflashing reciever with a continuous bead of the specified polyurethane sealant. End joints shall be interlocking and overlapping not less than 3”. Corners shall be mitered and sealed to a watertight condition. The bottom of the cap flashing insert shall project ¼” from the face of the wall with a down turned drip edge. The new counterflashing shall cover the termination bar and top of the roof flashing system a minimum of four (4) inches.

3. Install counterflashing system in accordance with plan details and in accordance with referenced standards and manufacturer’s instructions.

END OF SECTION 07 60 00

SECTION 078100

SPRAYED FIRE-RESISTIVE MATERIALS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the sprayed fire-resistive materials as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Spray-on fireproofing for structural steel and metal decking.

2. Seal coat over fireproofing in special areas.

3. Preparation of surfaces.

4. Field quality control.

1.3 RELATED SECTIONS

A. Structural steel – Section 051200.

B. Metal decking – Section 053100.

C. Firestops and smokeseals – Section 078413.

1.4 SUBMITTALS

A. Product Data: For each fire-resistive product specified.

B. Shop Drawings: Submit structural framing plans indicating the following:

1. Locations and types of surface preparations required before applying sprayed fire-resistive material.

2. Extent of sprayed fire-resistive material for each construction and fire-resistance rating, including the following:

a. Applicable fire-resistive design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.

3. Identify restrained and unrestrained assemblies on shop drawings, show required thickness of fireproofing for each assembly.

C. Product Certificates: Signed by manufacturer of sprayed fire-resistive material certifying that the products furnished comply with requirements.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. If primer is to be used steel and/or metal deck, submit certifications by supplier of primer that primer is compatible with materials, and will not impair the required performance of the installed fireproofing. Such certification shall be accompanied by evidence that the primer was successfully used in conjunction with the fireproofing material in a UL test applicable to the construction. Submit certification prior to application of primer.

1. Coordinate with Section 051200 – Structural Steel and 053100 – Metal Deck, and Structural Drawings prior to application of primer.

G. Product Test Reports: Indicate that physical properties of proposed sprayed fire- resistive materials comply with specified requirements based on comprehensive testing of current product formulations by a qualified testing and inspecting agency according to requirements specified in "Quality Assurance" Article.

H. Code Compliance: Proposed product must comply with prevailing Building Code and be approved by those individuals having jurisdiction.

I. Letter from manufacturer stating that the UL Design selected for the project is not load restricted.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as having the necessary experience, staff, and training to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its sprayed fire-resistive materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

B. Submit data indicating that products containing no detectable asbestos as determined according to the method specified in 40 CFR, Part 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

C. Mockups: After processing of initial submittals and before delivery and installation of fireproofing materials, prepare a sample installation of fireproofing work, approximately 100 sq. ft. in area; providing an example of each type required, applied on each different substrate, to produce each different rating as required and reasonably representative of entire sprayed on fireproofing work, for joint approval by representative of fire resistant material manufacturer and Owner. Work in other areas shall not proceed until mock-up has been completed. Mock-up work which remains in compliance with requirements and is in undamaged and acceptable condition may be retained as final work in place.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; shelf life, if applicable; and fire-resistance ratings applicable to Project.

B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

C. Store materials inside, under cover, aboveground, so they are kept dry until ready for use. Remove from Project site and discard materials that have deteriorated.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply sprayed fire-resistive material when ambient or substrate temperatures are 40 deg F. or lower, unless temporary protection and heat is provided to maintain temperatures at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of sprayed fire-resistive material to achieve a minimum of four air changes per hour. Use natural means or, where this is inadequate, forced-air circulation until fire-resistive material dries thoroughly.

1.8 SEQUENCING

A. Sequence and coordinate application of sprayed fire-resistive materials with other related work specified in other Sections to comply with the following requirements:

1. Provide temporary enclosures for interior applications to prevent deterioration of fire-resistive material due to exposure to unfavorable environmental conditions.

2. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.

3. Do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material. Fireproofing shall be considered dry when the moisture content is 6% or less.

4. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.

5. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.

6. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, tested, and corrections have been made to defective applications.

7. Protect permanently exposed walls, floor or special surfaces.

1.9 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty, executed by Contractor and cosigned by Installer, agreeing to repair or replace sprayed fire-resistive materials that fail within the specified warranty period.

1. Failures include, but are not limited to, cracking, flaking, eroding in excess of specified requirements; peeling; and delaminating of sprayed fire-resistive materials from substrates due to defective materials and workmanship within the specified warranty period.

2. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.

C. Warranty Period: Three (3) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

A. General: For concealed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated in this Article for material composition and physical properties representative of installed products.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

B. UL design listings must state that the loading was determined by Allowable Stress Design Method or Load and Resistance Factor Design Method. UL design listings requiring a load restriction factor will not be allowed.

C. Material Composition: As follows:

1. Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of gypsum or Portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.

D. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property listed as follows:

1. Dry Density: Minimum 15 lb./cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistive design, or greater if required to

attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Appendix A, "Alternate Method for Density Determination."

2. Thickness: Provide minimum average thickness required for fire-resistive design shown on approved submittals.

   a. Fireproofing shall be of thicknesses and density to meet the requirements of the NJDCA for Type of construction indicated on drawings.

3. Bond Strength: Not less than 200 lbf/sq. ft. per ASTM E 736.

4. Compressive Strength: 5.21 lbf/sq. in. as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 15 lb./cu. ft.

5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.

6. Deflection: No cracking, spalling, delamination, or the like per ASTM E 759.

7. Effect of Impact on Bonding: No cracking, spalling, delamination, or the like per ASTM E 760.

8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch, maximum dry density is 15 lb./cu. Ft., test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.

9. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

   a. Flame Spread: 10 or less.
   b. Smoke Developed: 0.

10. Fungal Resistance: No observed growth on specimens per ASTM G 21.

E. Products: Subject to compliance with requirements, provide products by one of the following:

1. Cementitious Sprayed Fire-Resistive Material

   a. Pyrolite 5GP; Carboline Co., Fireproofing Products Div.
   b. Monokote Type MK-6; GCP Applied Technologies.
   c. Cafco 300; Isolatek International Corp., Cafco Products.
   d. Type F3; Promat Firetemp.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS FOR EXPOSED FIREPROOFING

A. General: For exposed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated for material

composition and for minimum physical properties of each product listed, measured by standard test methods referenced with each property.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

B. UL design listings must state that the loading was determined by Allowable Stress Design Method or Load and Resistance Factor Design Method. UL design listings requiring a load restriction factor will not be allowed.

C. Cementitious Sprayed Fire-Resistive Material: Factory-mixed, dry, cement aggregate formulation, chloride-free formulation of Portland cement binders, additives, and inorganic aggregates, mixed with water at Project site to form a slurry or mortar for conveyance and application, complying with the following requirements:

1. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Appendix A, "Alternate Method for Density Determination," but with an average density of not less than 22 lb./cu. ft.

2. Bond Strength: 425 psf minimum per ASTM E 736.

3. Compressive Strength: 10,000 psf. per ASTM E 761.

4. Corrosion Resistance: No evidence of corrosion per ASTM E 937.

5. Deflection: No cracking, spalling, delamination, or the like per ASTM E 759.

6. Effect of Impact on Bonding: No cracking, spalling, delamination, or the like per ASTM E 760.

7. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. per ASTM E 859.

8. Combustion Characteristics: Passes ASTM E 136.

9. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

   a. Flame Spread: 10 or less.
   b. Smoke Developed: 0.

10. Fungal Resistance: No observed growth on specimens per ASTM G 21.

11. For exterior applications of sprayed fire-resistive material, provide manufacturer's formulation approved for surfaces exposed to the exterior.

D. Products: Subject to compliance with requirements, provide one of the following:

1. Cement-Aggregate Cementitious Sprayed Fire-Resistive Material:

   a. Pyrocrete 239; Carboline Co., Fireproofing Products Div.
   b. Monokote Type Z106HY; GCP Applied Technologies.

c. F4; Promat Firetemp.
d. Cafco 400, Isolatek International Corp; Cafco Products.

2.3 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with sprayed fire-resistive materials and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistive designs indicated.

B. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of sprayed fire-resistive material, used where required by manufacturer to ensure proper bond.

C. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistive designs indicated and fire-resistive product manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.

D. Sealer for Sprayed Fire-Resistive Material in Elevator Shafts and Open Area Plenums: Transparent-drying, water-dispersible protective coating by manufacturer of fire- resistive material.

1. Product: Subject to compliance with requirements, provide "Firebond Concentrate" by GCP Applied Technologies, or similar product recommended by the manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, to determine whether they are in satisfactory condition to receive sprayed fire-resistive material. A substrate is in satisfactory condition if it complies with the following:

1. Substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt, or other foreign substances capable of impairing bond of fire- resistive material with substrate under conditions of normal use or fire exposure.

2. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

3. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.

B. Do not proceed with installation of fire-resistive material until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances that could impair bond of fire-resistive material, including oil, grease, rolling compounds, incompatible primers, and loose mill scale.

B. For exposed applications, repair substrates to remove any surface imperfections that could affect uniformity of texture and thickness in finished surface of sprayed fire- resistive material. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

C. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application. Provide temporary enclosure as required to confine spraying operations, protect the environment, and ensure maintenance of adequate ambient conditions for temperature and ventilation.

3.3 INSTALLATION

A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to convey and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

B. Install metal lath, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by fire-resistive material manufacturer. Attach lathing accessories where indicated or required for secure attachment to substrate.

C. Coat substrates with adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by fire-resistive material manufacturer for material and application indicated.

D. Extend fire-resistive material in full thickness over entire area of each substrate to be protected.

E. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by method recommended by the manufacturer.

F. Where sealers are used, apply products that are tinted to differentiate them from the sprayed fire-resistive material over which they are applied.

G. Maintain ambient conditions during installation and for cure period following installation, as recommended by manufacturer. Provide ventilation and avoid excessive rate of drying.

H. Fireproofing to the underside of roof deck assemblies shall be done only after roofing application is complete, all roof mounted mechanical equipment is in place, and the roof is watertight.

I. No fireproofing shall be applied prior to completion of concrete work on steel decking.

J. Installation Sequence of Fireproofing: All patching and repairing of sprayed fireproofing, due to cutting by other trades or testing and inspection, shall be performed under this Section.

K. Provisions shall be made for ventilation to properly dry the fireproofing after application. In enclosed areas lacking natural ventilation, air circulation and ventilation must be provided.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing and inspecting of completed applications of sprayed fire-resistive material will take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of fire-resistive material for the next area until test results for previously completed applications of fire-resistive material show compliance with requirements.

1. For each 1000-sq. ft. area, or partial area, on each floor, testing and inspecting agency will evaluate the following characteristics. Tested values must equal or exceed values indicated and values required for approved fire-resistance design.

a. Thickness for Floors, Roofs, and Walls: From the average of 10 measurements from a 144-sq. in. sample area, with sample width of not less than 6 inches per ASTM E 605.

2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.

3. For each 10,000 sq. ft. area, or partial area, on each floor, testing and inspection agency will evaluate the following characteristics. Tested values must equal or exceed values indicated and values required for approved fire resistance design.

a. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: Cohesion and adhesion at frequency and from sample size indicated for determining thickness of each type of construction, per ASTM E 736.

4. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction, per ASTM E 605 or AWCI Technical Manual 12-A, Appendix A, "Alternate Method for Density Determination."

5. When testing discovers applications of fire-resistive material not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.

C. Remove and replace applications of fire-resistive material where test results indicate that they do not comply with specified requirements for cohesion and adhesion or for density, or both.

D. Apply additional fire-resistive material per manufacturer's written instructions where test results indicate that thickness does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 CLEANING, PROTECTING, AND REPAIR

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Cure exposed sprayed fire-resistive material according to product manufacturer's written recommendations to prevent premature drying.

C. Protect fire-resistive material, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at the time of Substantial Completion.

D. Coordinate application of fire-resistive material with other construction to minimize the need to cut or remove fire protection. As installation of other construction proceeds, inspect fire-resistive material and patch any damaged or removed areas.

1. Patch and repair fireproofing where Owner’s Testing Agency has performed tests.

E. Repair or replace work that has not been successfully protected.

END OF SECTION

SECTION 078413

FIRESTOPS AND SMOKESEALS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the firestops and smokeseals as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.

4. Sealant joints in fire-resistance-rated construction.

5. Penetrations at each floor level in shafts and/or stairwells.

6. Construction joints, including those between top of fire rated walls and underside of floors above.

1.3 RELATED SECTIONS

A. Cast-in-place concrete - Section 033000.

B. Unit masonry - Section 042000.

C. Joint sealers - Section 079200.

D. Drywall - Section 092900.

E. Piping penetrations - Division 22.

F. Duct penetrations - Division 23.

G. Cable and conduit penetrations - Division 26.

1.4 REFERENCES

A. ASTM E 814 "Standard Method of Fire Tests of Through-Penetration Firestops."

B. UL 1479, UBC 7-5 (Both are same as A. above).

C. ASTM E 136 "Standard Test Method for Assessing Combustibility of Materials."

D. UL 263, UBC 7-1 "Fire Tests of Building Construction and Materials"

E. UL 2079 "Tests For Fire Resistance of Building Joint Systems."

F. ASTM E 1399 "Test For Dynamic Movement Conditions."

G. ASTM E 1966 (Same as E. above).

H. ASTM G 21 "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi."

I. Test Requirements: ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus."

J. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Firestops."

K. Published Through-Penetration Systems by recognized independent testing agencies.

1. UL Fire Resistance Directory, Volume II of current year.

2. Warnock Hersey Certification Listings, current year.

3. Omega Point Laboratories, current year.

L. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.

1.5 SUBMITTALS

A. Submit manufacturer's product literature for each type of firestop material to be installed. Literature shall indicate product characteristics, typical uses, performance, limitation criteria, test data and indication that products comply with specified requirements.

B. Submit shop drawings detailing materials, installation methods, and relationships to adjoining construction for each firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include

firestop design designation of qualified testing and inspection agency evidencing compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, for proposed UL listed (or equal) firestop and smokeseal assembly required for the Project.

C. Material Safety Data Sheets: Submit MSDS for each firestop product.

D. Submit qualifications of firestop installer, including letter from firestop manufacturer of products proposed to be installed, wherein manufacturer approves or recognizes as trained/ or certifies installer for installation of that manufacturer's products.

E. Engineering Judgment: For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

1.6 QUALITY ASSURANCE

A. General: Provide firestopping systems that are produced and installed to resist the spread of fire and the passage of smoke and other gases.

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single sole source firestop specialty contractor.

C. Firestopping materials shall conform to Flame (F) and Temperature (T) ratings as required by local building code and as tested by nationally accepted test agencies per ASTM E 814 or UL 1479. The F-rating must be a minimum of one (1) hour, but not less than the fire resistance rating of the assembly being penetrated. T-rating, when required by code authority, shall be based on measurement of the temperature rise on the penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.

1. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

a. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
b. T-Rating: When penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
c. W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

2. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

    a. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.

D. Firestopping products shall be asbestos free and free of any PCBs.

E. Do not use any product containing solvents or that requires hazardous waste disposal.

F. Do not use firestop products which after curing, dissolve in water.

G. Do not use firestop products that contain ceramic fibers.

H. Firestopping Installer Qualifications: Firestop application shall be performed by a single firestopping contractor who specializes in the installation of firestop systems, whose personnel to be utilized have received specific training and certification or approval from the proposed respective firestop manufacturer, and firestop installer shall have a minimum of three years' experience (under present company name) installing firestop systems of the type herein specified.

I. Mock-Up: Prepare job site mock-ups of each typical Firestop System proposed for use in the project. Approved mock-ups will be left in place as part of the finished project and will constitute the quality standard for the remaining work.

J. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

K. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of less than or equal to 1 as determined by ASTM G 21.

L. Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post-installed." Provide cast-in-place firestop devices prior to concrete placement.

M. Firestop systems do not reestablish the structural integrity of load bearing partitions or assemblies, or support live loads and traffic. Installer shall consult the Structural Engineer prior to penetrating any load bearing assembly.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original unopened containers with manufacturer's name, product identification, lot numbers, UL or Warnock Hersey labels, and mixing and installation instructions, as applicable.

B. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturer.

C. All firestop materials shall be installed prior to expiration of shelf life.

1.8 PROJECT CONDITIONS

A. Verify existing conditions and substrates before starting work

B. Do not use materials that contain solvents, show sign of damage or are beyond their shelf life.

C. During installation, provide masking and drop cloths as needed to prevent firestopping products from contaminating any adjacent surfaces.

D. Conform to ventilation requirements if required by manufacturer's installation instructions or Material Safety Data Sheet.

E. Weather Conditions: Do not proceed with installation of firestop products when temperatures are in excess or below the manufacturer's recommendations.

F. Schedule installation of firestop products after completion of penetrating item installation but prior to covering or concealing of openings.

G. Coordinate this work as required with work of other trades.

1.9 SEQUENCING AND SCHEDULING

A. Pre-Installation Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

B. Sequence: Perform work of this and other sections in proper sequence to prevent damage to the firestop systems and to ensure that their installation will occur prior to enclosing or concealing work.

C. Install all firestop systems after voids and joints are prepared sufficiently to accept the applicable firestop system.

D. Do not cover firestop systems until they have been properly inspected and accepted by the authority having jurisdiction.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following manufacturers:

1. Hilti, Inc.
2. Metacaulk.
3. Nelson.
4. Specified Technologies Inc.
5. 3M.
6. Tremco.
7. U.S. Gypsum Co.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

B. Accessories: Provide components for each firestopping system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:

1. Permanent forming/damming/backing materials including the following:
    a. Semirefractory fiber (mineral wool) insulation.
    b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
    c. Fire-rated form board.
    d. Joint fillers for joint sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

D. Smokeseals at top of partitions shall be flexible to allow for partition deflection.

E. Polypropylene Sleeves (PP): (For cast-in device options.)

2.3 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

A. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.

B. Intumescent, Latex Sealant: Single-component, Intumescent, latex formulation.

C. Intumescent Putty: Non-hardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.

D. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum or polyethylene foil on one side.

E. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.

F. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.

G. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

H. Moldable putty pads by 3M or approved equal.

I. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, non-shrinking foam.

J. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and non-sag formulation for openings in vertical and other surfaces requiring a non-slumping/gunnable sealant, unless firestop system limits use to non-sag grade for both opening conditions.

K. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic or polypropylene sleeve lined with an intumescent strip, an extended rectangular flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

L. Fire Rated Cable Management Devices: Factory-assembled round metallic sleeve device for use with cable penetrations, containing an integrated smoke seal fabric membrane that can be opened and closed for re-penetration.

M. Drop-In Firestop Devices: Factory-assembled devices for use with combustible or noncombustible penetrants in cored holes within concrete floors. Device shall consist of galvanized steel sleeve lined with an intumescent strip, an extended rectangular flange attached to one end of the sleeve for fastening to concrete floor, and neoprene gasket.

N. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

O. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

P. Blocks/Plugs: Intumescent flexible block/plug suitable for reuse in re- penetration of openings. Blocks shall allow up to 12” of unreinforced annular space.

Q. Tub Box Kit: Cast-in place pre-formed plastic tub box kit with three support legs for use with drain piping assembly associated with bathtub installations.

2.4 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.

1. Sealant Colors: Color of exposed joint sealants as selected by the Architect.

B. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.

1. Additional Movement Capability: Provide sealant with the capability to withstand 33 percent movement in both extension and compression for a total of 66 percent movement.

C. Multi-Component, Non-Sag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.

1. Additional Movement Capability: Provide sealant with the capability to withstand 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement in joint width existing at time of installation, when tested for adhesion and cohesion under

maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated.

D. Single-Component, Non-Sag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.

2.5 MINERAL FIBER/CERAMIC WOOL NON-COMBUSTIBLE INSULATION (FIRE SAFING)

A. Provide min. 4 pcf safing insulation to suit conditions and to comply with fire resistance and firestop manufacturer's requirements.

B. Material shall be classified non-combustible when tested per ASTM E 136.

C. Acceptable Manufacturers:

1. Thermafiber, Inc. (an Owens Corning company); Thermafiber Safing Mineral Wool Insulation

2. Rockwool; Roxul Safe Fire Safing Insulation

3. Johns Manville; Mineral Wool Safing

2.6 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions with Installer present, for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.

2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

3.3 CONDITIONS REQUIRING FIRESTOPPING

A. Interior Walls and Partitions

1. Construction joints between top of fire rated walls and underside of floors above, shall be firestopped.

2. Firestop system installed shall have been tested by either UL or Omega Point, including exposure to hose stream test and including for use with steel fluted deck floor assemblies.

3. Firestop system used shall allow for deflection of floor above.

B. Penetrations

1. Penetrations include conduit, cable, wire, pipe, duct, or other elements which pass through one or both outer surfaces of a fire rated floor, wall, or partition.

2. Except for floors on grade, where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof, provide firestopping to fill such spaces in accordance with ASTM E 814.

3. These requirements for penetrations shall apply whether or not sleeves have been provided, and whether or not penetrations are to be equipped with escutcheons or other trim. If penetrations are sleeved, firestop annular space, if any, between sleeve and wall of opening.

C. Provide firestopping to fill miscellaneous voids and openings in fire rated construction in a manner essentially the same as specified herein before.

3.4 INSTALLING THROUGH PENETRATION FIRESTOPS

A. General: Comply with the through penetrations firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 INSTALLING FIRE RESISTIVE JOINT SEALANTS

A. General: Comply with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire resistance rating required.

C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool no sag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.6 INSTALLING FIRESAFING INSULATION

A. Install fire safing insulation utilizing welded or screw applied galvanized steel impaling pins and retaining clips; space clips or pins 24" o.c. maximum.

B. Completely fill voids in areas where safing insulation is required. At spandrel conditions/floor edges, depth of insulation top to bottom shall be at least four (4) inches.

C. Cover top of all safing insulation with firestop sealant or spray.

3.7 FIELD QUALITY CONTROL

A. Inspecting agency employed and paid by the Owner will examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.

B. Inspecting agency will report observations promptly and in writing to Contractor, Owner and Architect.

C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.

D. Where deficiencies are found, Contractor must repair or replace firestopping so that it complies with requirements.

3.8 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which openings and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to product firestopping complying with specified requirements.

END OF SECTION

SECTION 079200

JOINT SEALERS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the joint sealers work as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Flashing reglets and retainers.
2. Coping joints.
3. Exterior wall joints not specified to be sealed in other Sections of work.
4. Interior wall joints not specified to be sealed in other Sections of work, including caulking to fill between architectural woodwork and any wall, floor and/or ceiling imperfections.
5. Control and expansion joints in walls.
6. Joints at wall penetrations.
7. Joints between items of equipment and other construction.
8. All other joints required to be sealed to provide a positive barrier against penetration of air and moisture.

1.3 RELATED SECTIONS

A. Firestop sealants - Section 078413.

B. Aluminum entrances and storefronts - Section 084113.

C. Glazing sealants - Section 088000.

D. Sealant within drywall construction - Section 092900.

E. Sealant at tile work - Section 093000

1.4 QUALITY ASSURANCE

A. Qualification of Installers: Use only personnel who are thoroughly familiar, skilled and specially trained in the techniques of sealant work, and who are completely familiar with the published recommendations of the sealant manufacturer.

B. Pre-Construction Field Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to project joint substrates according to the method in ASTM C794 and C 1521 that is appropriate for the types of Project joints.

C. Perform testing per ASTM C1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work shall start until results of these tests have been submitted to the Architect and he has given his written approval to proceed with the work.

1.5 SUBMITTALS

A. Shop Drawings: Submit shop drawings showing all joint conditions, indicating relation of adjacent materials, all sealant materials (sealant, bond breakers, backing, primers, etc.), and method of installation.

1. Submit joint sizing calculations certifying that movement capability of sealant is not being exceeded.

B. Samples: Submit the following:

1. Color samples of sealants, submit physical samples (not color chart).

2. Sealant bond breaker and joint backing.

C. Product Data: Submit manufacturer's technical information and installation instructions for:

1. Sealant materials, indicating that material meets standards specified herein.

2. Backing rods.

D. Submit manufacturer's certification as required by Article 1.6 herein.

E. Submit results of testing required in Article 1.4 herein.

1.6 MANUFACTURER'S RESPONSIBILITY AND CERTIFICATION

A. Contractor shall require sealant manufacturer to review the Project joint conditions and details for this Section of the work. Contractor shall submit to the Architect written certification from the sealant manufacturer that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vaportight seals (as applicable), and that materials supplied meet specified performance requirements.

1.1 ENVIRONMENTAL CONDITIONS

A. Temperature: Install all work of this Section when air temperature is above forty (40) degrees F. and below eighty (80) degrees F., unless manufacturer submits written instructions permitting sealant use outside of this temperature range.

B. Moisture: Do not apply work of this Section on surfaces which are wet, damp, or have frost.

1.2 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section, before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

C. Storage

1. Store sealant materials and equipment under conditions recommended by their manufacturer.

2. Do not use materials stored for a period of time exceeding the maximum recommended shelf life of the material.

3. Material shall be stored in unopened containers with manufacturers' name, batch number and date when shelf life expires.

1.3 GUARANTEE

A. Provide a written, notarized guarantee from the manufacturer stating that the applied sealants shall show no material failure for a period of ten (10) years.

B. Contractor to provide a written, notarized, guarantee stating that the applied sealants shall show no failure due to improper installation for a period of five (5) years.

C. Guarantee shall be in a form acceptable to the Owner and executed by an authorized individual.

D. Include in guarantee provision, agreement to repair and/or replace, at Contractor's expense, sealant defects which develop during guarantee period, because of faulty labor and/or materials.

PART 2 PRODUCTS

2.1 SEALANT MATERIALS

A. Exterior Wall Sealant: Provide one (1) part non-sag sealant conforming to the minimum standards of ASTM C920, Type S, Grade NS, Class 50.

B. Acceptable Manufacturers:

1. The Dow Chemical Company; DOWSIL 790 or DOWSIL 795
2. G.E.; Silpruf SCS 2000 or LM SCS 2700
3. Tremco; Spectrem 1 or Spectrem 3
4. Sonneborn; Sonolastic 150

C. Interior Sealant: Provide a one (1) part acrylic based sealant conforming to ASTM C834.

D. Acceptable Manufacturers:

1. Pecora; AC-20+ Silicone
2. BASF; Masterseal NP 520
3. Tremco

E. Colors: Colors selected from manufacturer's standard selection.

2.2 MISCELLANEOUS MATERIALS

A. Back-Up Materials: Provide back-up materials and preformed joint fillers, non-staining, non-absorbent, compatible with sealant and primer, and of a resilient nature; twenty-five (25) percent wider than joint width. Materials impregnated with oil, bitumen or similar materials shall not be used. Provide back-up materials only as recommended by sealant manufacturer in writing.

B. Provide bond breakers, where required, of polyethylene tape as recommended by manufacturer of sealant.

C. Provide primers recommended by the sealant manufacturer for each material to receive sealant. Note that each exterior joint must be primed prior to sealing.

D. Provide solvent, cleaning agents and other accessory materials as recommended by the sealant manufacturer.

E. Materials shall be delivered to the job in sealed containers with manufacturer's original labels attached. Materials shall be used per manufacturer's printed instructions.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where joint sealers are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with instructions and recommendations of the manufacturer and in accordance with ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions required by this Project where more stringent installation requirements are specified herein, such requirements shall apply.

B. Sample Section of Sealant

1. During sealant installation work in exterior wall, the manufacturer of sealant shall send his representative to the site, under whose supervision a section of the wall (used as "control section") shall be completed for purposes of determining performance characteristics of sealant in joints. Architect shall be informed of time and place of such installation of control section.

2. Control section shall be installed according to specification given herein and shall not be considered as acceptable until written acceptance is provided by the Architect.

3. Accepted control section shall be standard to which all other sealant work must conform.

C. Supervision: The Contractor shall submit to the Architect written certification from the sealant manufacturer that the applicators have been instructed in the proper application of their materials. The Contractor shall use only skilled and experienced workmen for installation of sealant.

D. Apply sealant under pressure with a hand or power actuated gun or other appropriate means. Gun shall have nozzle of proper size and provide sufficient pressure to completely fill joints as detailed. Neatly point or tool joint to provide the contour as indicated on the drawings.

E. Preparation and Application

1. Thoroughly clean all joints, removing all foreign matter such as dust, oil, grease, water, surface dirt and frost. Sealant must be applied to the base surface. Previously applied film must be entirely removed.

2. Stone, masonry and concrete surfaces to receive sealant shall be cleaned where necessary by grinding, water blast cleaning, mechanical abrading, or combination of these methods as required to provide a clean, sound base surface for sealant adhesion.

a. Do not use any acid or other material which might stain surfaces.
b. Remove laitance by grinding or mechanical abrading.
c. Remove loose particles present or resulting from grinding, abrading, or blast cleaning by blowing out joints with compressed air, oil and water free, or vacuuming joints prior to application of primer or sealant.

3. Clean non-porous surfaces such as metal and glass chemically. Remove protective coatings on metallic surfaces by solvent that leaves no residue and is compatible with sealant. Use solvent and wipe dry with clean, dry lint free paper

towels. Do not allow solvent to air dry without wiping. Clean joint areas protected with masking tape or strippable films as above after removal of tape film.

4. Do not seal joints until they are in compliance with drawings, or meet with the control section standard.

5. Joint Size and Sealant Size: Joints to receive sealant shall be at least 1/4" wide. In joint 1/4" to 3/8" wide, sealant shall be 1/4" deep. In joints wider than 3/8" and up to 1" wide, sealant depth shall be one half the joint width. For joints wider than 1", sealant depth shall be as recommended by the sealant manufacturer. Depth of joint is defined as distance from outside face of joint to closest point of the filler.

6. Primer: Thoroughly clean joints and apply primer to all surfaces that will receive sealant. Apply primer on clean, dry surfaces, and prior to installation of joint backing. Completely wet both inner faces of the joint with primer. Mask adjacent surfaces of joint with non-staining masking tape prior to priming. Apply primer with clean brush and only when temperature is above 45 deg. F.

7. Joint Backing: In joints where depth of joint exceeds required depth of sealant, install joint backing (after primer is dry) in joints to provide backing and proper joint shape for sealant. Proper shape for sealant is a very slight "hourglass" shape, with back and front face having slight concave curvature. Use special blunt T- shaped tool or roller to install joint backing to the proper and uniform depth required for the sealant. Joint backing shall be installed with approximately twenty- five (25) percent compressions. Do not stretch, twist, braid, puncture, or tear joint backing. Butt joint backing at intersections.

8. Bond Breaker: Install bond breaker smoothly over joint backing so that sealant adheres only to the sides of the joint and not backing.

9. Sealant Application: Apply sealant in accordance with the manufacturer's application manual and manufacturer's instructions, using hand guns or pressure equipment, on clean, dry, properly prepared substrates, completely filling joints to eliminate air pockets and voids. Mask adjacent surfaces of joint with non-staining masking tape. Force sealant into joint in front of the tip of the "caulking gun" (not pulled after it) and force sealant against sides to make uniform contact with sides of joint and to prevent entrapped air or pulling of sealant off of sides. Fill sealant space solid with sealant.

10. Tooling: Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193. Finished joints shall be straight, uniform, smooth and neatly finished. Remove masking tape immediately after tooling of sealant and before sealant face starts to "skin" over. Neatly remove any excess sealant from adjacent surfaces of joint, leaving the work in a neat, clean condition.

11. Replace sealant which is damaged during construction process.

3.3 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 5 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
b. Perform one test for each 5,000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

END OF SECTION

SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the steel doors and frames work as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Interior and exterior hollow metal doors and frames for fire-rated and unrated door openings.
2. Trimmed openings.
3. Interior hollow metal vision panels.
4. Preparation of metal doors and frames to receive finish hardware, including reinforcements, drilling and tapping necessary.
5. Preparation of hollow metal doors to receive glazing where required.
6. Steel louvers for hollow metal doors.
7. Furnishing anchors for building into masonry and drywall.
8. Factory prime painting of work of this Section.

1.3 RELATED SECTIONS

A. Installation of doors and frames - Section 062000.

B. Wood Doors - Section 081416.

C. Finish Hardware - Section 087100.

D. Glass and Glazing - Section 088000.

E. Gypsum Drywall - Section 092900.

F. Painting and Finishing - Section 099000.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, compliance with standards referenced herein, sound and fire-resistance ratings, and finishes for each type of door and frame specified.

B. Shop Drawings: Show fabrication and installation of doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, reinforcement for surface applied hardware, dimensions of profiles and hardware preparation, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessories.

C. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Drawings.

1. Coordinate glazing frames and stops with glass and glazing requirements.

D. Oversize Construction Certification: For door assemblies required to be fire rated and exceeding limitations of labeled assemblies, submit certification of a testing agency acceptable to authorities having jurisdiction that each door and frame assembly has been constructed to comply with design, materials, and construction equivalent to requirements for labeled construction.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing custom steel doors and frames similar to those indicated for this Project and with a record of successful in- service performance, as well as sufficient production capacity to produce required units.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

C. Source Limitations: Obtain custom steel doors and frames through one source from a single manufacturer.

D. Fire-Rated Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1. Test Pressure: Test according to NFPA 252 or UL 10C. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40" or less above the sill.

2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-protection-rated door assemblies except for size.

3. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating as required by prevailing Building Code in 30 minutes of fire exposure.

E. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

F. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

G. Fire rated assemblies must have UL approved label.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palleted, wrapped, or crated to provide protection during transit and Project site storage. Do not use nonvented plastic.

B. Inspect doors and frames, on delivery, for damage. Minor damage may be repaired provided refinished items match new work and are approved by Architect; otherwise, remove and replace damaged items as directed.

C. Store doors and frames under cover at building site. Conform to the requirements of ANSI/SDI A250.11 for site storage unless more stringent requirements are noted herein. Place units on minimum 4-inch high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

PART 2 PRODUCTS

2.1 FABRICATION - GENERAL

A. Fabricate hollow metal units to be rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible. Metallic filler to conceal manufacturing defects is not acceptable.

B. Unless otherwise indicated, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.

C. Prepare hollow metal units to receive finish hardware, including cutouts, reinforcing, drilling and tapping in accordance with Finish Hardware Schedule and templates provided by hardware suppliers. Comply with applicable requirements of ANSI A115 "Specifications for Door and Frame Preparation for Hardware."

D. Locate finish hardware as shown on final shop drawings in accordance with locations noted herein.

2.2 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products manufactured by Steelcraft, Curries, Ceco Door Products, or Fleming.

B. Exterior Doors and Frames

1. Basis of Design Energy Efficient: Curries; 797 Mercury Series.

2. Basis of Design: Curries Company (CU); Thermal Break TQ Series.

2.3 FRAMES

A. Materials

1. Frames for exterior openings shall be made of commercial grade cold-rolled steel conforming to ASTM A 1008, Type B not less than 14 ga., and shall have a hot dipped galvannealed coating conforming to ASTM A 924 and A 653 with A60 coating. The zinc-alloy coating shall be a dull matte surface treated for paint adhesion.

2. Frames for interior openings shall be either commercial grade cold-rolled steel conforming to ASTM A 1008, Type B or commercial grade hot-rolled steel conforming to ASTM A 1011, Commercial Steel, Type B. Metal thickness shall be not less than sixteen (16) ga. for frames in openings 4'-0" or less in width; not less than fourteen (14) ga. for frames in openings over 4'-0" in width.

B. Design and Construction

1. All frames shall be welded units with integral trim, of the sizes and shapes shown on approved shop drawings. Knock-down frames are not permitted.

2. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16” positive thermal break and integral vinyl weatherstripping.

3. All finished work shall be strong and rigid, neat in appearance, square, true and free of defects, warp or buckle. Molded members shall be clean cut, straight and of uniform profile throughout their lengths.

4. Jamb depths, trim, profile and backbends shall be as shown on drawings.

   a. Frames at drywall partitions shall be formed with double return backbends to prevent cutting into drywall surface.

5. Welded frames shall have corners mitered and reinforced and faces of welded frames shall be continuously back welded full depth and width of frame conforming to NAAMM Standard HMMA-820; face joints shall be hairline.

6. Minimum depth of stops shall be 5/8".

7. Frames for multiple or special openings shall have mullion and/or rail members which are closed tubular shapes having no visible seams or joints. All joints between faces of abutting members shall be securely welded and finished smooth.

   a. Mullions shall have 16 ga. internal steel stiffeners welded not less than 4" o.c.

8. Hardware Reinforcements

a. Frames shall be mortised, reinforced, drilled and tapped at the factory for fully-templated mortised hardware only, in accordance with approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates.

b. Minimum thickness of hardware reinforcing plates shall be as follows (contractor shall provide larger and thicker plates as required to accommodate weight of door):
   1). Hinge and pivot reinforcements - seven (7) ga., 1-1/4" x 10" minimum size.
   2). Strike reinforcements - twelve (12) gauge.
   3). Flush bolt reinforcements - twelve (12) gauge.
   4). Closer reinforcements - twelve (12) gauge.
   5). Reinforcements for surface mounted hardware - twelve (12) gauge.

9. Floor Anchors

   a. Provide adjustable floor anchors, providing not less than two (2) inch height adjustment.
   b. Minimum thickness of floor anchors shall be fourteen (14) gauge.

10. Jamb Anchors

   a. Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the wire type. Anchors shall be not less than 0.156" diameter steel wire. The number of anchors provided on each jamb shall be as follows:
      1). Frames up to 7'-6" height - three (3) anchors.
      2). Frames 7'-6" to 8'-0" height - four (4) anchors.
      3). Frames over 8'-0" height - one (1) anchor for each 2'-0" or fraction thereof in height.
   b. Frames for installation in stud partitions shall be provided with steel anchors of suitable design, not less than eighteen (18) gauge thickness, securely welded inside each jamb as follows:
      1). Frames up to 7'-6" height - four (4) anchors.
      2). Frames 7'-6" to 8'-0" height - five (5) anchors.
      3). Frames over 8'-0" height - five (5) anchors plus one additional for each 2'-0" or fraction thereof over 8'-0".
   c. Frames to be anchored to previously placed concrete or masonry shall be provided with minimum 3/8" concealed bolts set into expansion shields or inserts at six (6) inches from top and bottom and twenty-four (24) inches o.c. Reinforce frames at anchor locations with sixteen (16) gauge sheet steel stiffeners welded to frame at each anchor.

11. Anchors in exterior frames and in masonry walls shall be hot dip galvanized per ASTM A 153.

12. Frames for installation in masonry wall openings more than 4'-0" in width shall have an angle or channel stiffener factory welded into the head. Such stiffeners shall be not less than twelve (12) gauge steel and not longer than the opening width and shall not be used as lintels or load bearing members.

13. Dust cover boxes (or mortar guards) of not thinner than twenty-six (26) gauge steel shall be provided at all hardware mortises on frames to be set in masonry or plaster partitions.

14. Ceiling Struts: Minimum 3/8" thick x 2" wide steel.

15. All frames shall be provided with a steel spreader temporarily attached to the feet of both jambs to serve as a brace during shipping and handling.

16. Loose glazing stops shall be of cold rolled steel, not less than twenty (20) gauge thickness, butted at corner joints and secured to the frame with countersunk cadmium-or zinc-plated screws. Interior frames may be provided with snap-on glazing stops.

17. Except on weather-stripped frames, drill stops to receive three (3) silencers on strike jambs of single door frames and two (2) silencers on heads of double-door frames.

C. Finish: After fabrication, all tool marks and surface imperfections shall be removed, and exposed faces of all welded joints shall be dressed smooth. Frames shall then be chemically treated to ensure maximum paint adhesion and shall be coated on all surfaces with one coat of rust-inhibitive baked-on alkyd primer standard with the manufacturer which is fully cured before shipment to a dry film thickness of 2.0 mils.

1. Frames set in masonry walls shall be grouted in as described in Section 042000 "Unit Masonry." These frames shall have surfaces in contact with grout shop coated with epoxy coating spray applied at 4 to 6 mils, passing NFPA 101, Class A for smoke and flame spread, tested per ASTM E 84.

a. Basis of Design: Tnemec; Series 27 FC Typoxy
b. Other Acceptable Manufacturers:
1). PPG
2). Benjamin Moore
3). Sherwin Williams

2.4 HOLLOW METAL DOORS

A. Materials: Doors shall be made of commercial quality, level, cold rolled steel conforming to ASTM A 1008, Commercial Steel, Type B and free of scale, pitting or other surface defects. Face sheets for interior doors shall be not less than eighteen (18) gauge. Face sheets for exterior doors shall be not less than sixteen (16) gauge and shall have a hot dipped galvannealed coating conforming to ASTM A 924 and A 653, A60 coating. The zinc alloy coating shall be a dull matte surface treated for paint adhesion.

B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, and ANSI/SDI A250.4 for physical performance level.

1. Design: Flush panel.

2. Core Construction: Foamed in place polyurethane and steel reinforced core with no stiffener face welds.

    a. Provide 16 gauge steel vertical reinforcements 6 inches apart and welded in place. Foamed in place polyurethane core is chemically bonded to all interior surfaces. No face welding is permitted.
    b. Thermal properties to rate at a fully operable minimum U-Factor 0.374 and R-Value 2.53, including insulated door, Mercury thermal-break frame and threshold.
    c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.378 and R-Value 2.5, including insulated door, kerf type frame, and threshold.

C. Design and Construction

1. All doors shall be of the types and sizes shown on the approved shop drawings, and shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges. Minimum door thickness shall be 1-3/4".

2. All doors shall be strong, rigid and neat in appearance, free from warpage or buckles. Corner bends shall be true and straight and of minimum radius for the gauge of metal used.

3. Face sheets shall be stiffened by continuous vertical formed steel sections spanning the full thickness of the interior space between door faces. These stiffeners shall be not less than twenty-two (22) gauge spaced not more than six (6) inches apart and securely attached to face sheets by spot welds not more than five (5) inches o.c. Spaces between stiffeners shall be sound deadened and thermal insulated the full height of the door with an inorganic non-combustible batt type material.

4. Door faces shall be joined at their vertical edges by a continuous weld extending the full height of the door. All such welds shall be ground, filled and dressed smooth to make them invisible and provide a smooth flush surface.

5. Top and bottom edges of all doors shall be closed with a continuous recessed steel channel not less than fourteen (14) gauge, extending the full width of the door and spot welded to both faces. Exterior doors shall have an additional flush closing channel at their top edges and, where required for attachment of weather stripping, a flush closure also at their bottom edges. Openings shall be provided in the bottom closure of exterior doors to permit the escape of entrapped moisture.

6. Edge profiles shall be provided on both vertical edges of doors as follows:

    a. Single-acting swing doors - beveled 1/8" in two (2) inches.
    b. Double acting swing doors - rounded on 2-1/8" radius.
    c. No square edge doors permitted.

7. Hardware Reinforcements

    a. Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only in accord with the approved hardware schedule and

templates provided by the hardware supplier. Where surface-mounted hardware (or hardware, the interrelation of which is to be adjusted upon installation - such as top and bottom pivots, floor closers, etc.) is to be applied, doors shall have reinforcing plates.

b. Minimum gauges for hardware reinforcing plates shall be as follows (contractor shall provide larger and thicker plates as required to accommodate weight of door):
   1). Hinge and pivot reinforcement - seven (7) gauge.
   2). Reinforcement for lock face, flush bolts, concealed holders, concealed or surface mounted closers - twelve (12) gauge.
   3). Reinforcements for all other surface mounted hardware - sixteen (16) gauge.

8. Glass Moldings and Stops

   a. Where specified or scheduled, doors shall be provided with hollow metal moldings to secure glazing by others in accordance with glass opening sizes shown on drawings.
   b. Fixed moldings shall be securely welded to the door on the security side.
   c. Loose stops shall be not less than twenty (20) gauge steel, with mitered corner joints, secured to the framed opening by cadmium or zinc-coated countersunk screws spaced eight (8) inches o.c. Snap-on attachments will not be permitted. Stops shall be flush with face of door.

9. Louvers shall be sixteen (16) gauge sheet steel, stationary type, closely spaced inverted "V" blade design, flush with face sheets of door, integral with and welded to door. Fifty (50) percent free area, unless indicated otherwise on drawings.

D. Finish: After fabrication, all tool marks and surface imperfections shall be dressed, filled and sanded as required to make all faces and vertical edges smooth, level and free of all irregularities. Doors shall then be chemically treated to ensure maximum paint adhesion and shall be coated, on all exposed surfaces, with manufacturer's standard rust- inhibitive alkyd primer as specified for frames which shall be fully cured before shipment.

E. Flatness: Doors shall maintain a flatness tolerance of 1/16" maximum, in any direction, including in a diagonal direction.

2.5 LABELED DOORS AND FRAMES

A. Labeled doors and frames shall be provided for those openings requiring fire protection ratings as scheduled on drawings. Such doors and frames shall be labeled by Underwriters' Laboratories or other nationally recognized agency having a factory inspection service.

B. If any door or frame specified by the Architect to be fire-rated cannot qualify for appropriate labeling because of its design, size, hardware or any other reason, the Architect shall be so advised before fabricating work on that item is started.

2.6 HARDWARE LOCATIONS

A. The location of hardware on doors and frames shall be as noted in "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames" of the Door Hardware Institute unless otherwise required by prevailing Handicapped Codes.

2.7 CLEARANCES

A. Fabricate doors and frames to meet edge clearances as follows:

1. Jambs and Head: 1/8" plus or minus 1/16".

2. Meeting Edges, Pairs of Doors: 1/8" plus or minus 1/16".

3. Bottom: 3/4" if no threshold, 3/8" at threshold.

B. Fire rated doors shall have clearances as required by NFPA 80.

2.8 MANUFACTURING TOLERANCES

A. Manufacturing tolerance shall be maintained within the limits given in HMMA 841 of ANSI/NAAMM, current edition.

2.9 PREPARATION FOR FINISH HARDWARE

A. Prepare door and frames to receive hardware:

1. Hardware supplier shall furnish hollow metal manufacturer approved hardware schedule, hardware templates, and samples of physical hardware where necessary to ensure correct fitting and installation.

2. Preparation includes sinkages and cut-outs for mortise and concealed hardware.

B. Provide reinforcements for both concealed and surface applied hardware:

1. Drill and tap mortise reinforcements at factory, using templates.

2. Install reinforcements with concealed connections designed to develop full strength of reinforcements.

2.10 REJECTION

A. Hollow metal frames or doors which are defective, have hardware cutouts of improper size or location, or which prevent proper installation of doors, hardware or work of other trades, shall be removed and replaced with new at no cost.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where steel doors and frames are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do

not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Refer to Section 062000 for installation procedures for all work of this Section.

END OF SECTION

SECTION 081416

WOOD DOORS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the wood doors as shown on the drawings and/or specified herein, including but not limited to, the following:

1. Solid core flush wood doors.

2. Fire rated flush wood doors.

1.3 RELATED SECTIONS

A. Installation of wood doors - Section 062000.

B. Hollow metal frames - Section 081113.

C. Finish hardware - Section 087100.

D. Glass and glazing - Section 088000.

E. Field painting - Section 099000.

1.4 SUBMITTALS

A. Product Data: Submit door manufacturer’s product data, specifications and installation instructions for each type of wood door.

1. Include details of core and edge construction and trim for openings.

2. Include factory finish specifications.

3. Include certifications to show compliance with specifications.

4. Include certification to show compliance with AWI and WDMA requirements specified herein.

B. Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for finishing and other pertinent data.

1. Include requirements for veneer matching.

C. Submit the following

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated"; latest edition "Premium" grade and WDMA “Extra Heavy Duty” Performance Level.

1. Only manufacturers that are certified and listed by AWI to be QCP qualified are acceptable for this project.

2. Provide letter of licensing for Project indicating that doors comply with requirements of grade specified.

C. Fire Rated Wood Doors: Doors complying with Category A, Positive Pressure or Neutral Pressure testing standards per UBC 7-2-1997 and UL 10-C (UBC 7-2-1994 and UL 10B) that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated on Door Schedule, based on testing according to NFPA 252.

1. Conform to prevailing Code requirements to determine which pressure standard (Positive or Neutral) is required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer’s standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) in excess of permitted standard noted in Article 2.5 herein, or show telegraphing of core construction in face veneers.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

    a. Stile and Rail Wood Doors: Five years.

PART 2 PRODUCTS

2.1 SOLID CORE FLUSH WOOD DOORS

A. Provide AWI PC-5 Premium Grade hot pressed 5-ply solid core particleboard doors, 1-3/4" thick, conforming to standards specified herein.

1. Core shall consist of a formed flat panel consisting of wood particles bonded together with synthetic resins or other added binder, with an average density of 30 to 32 lbs. per cubic foot. The material shall meet or exceed the requirements of ANSI A208.1, Grade 1-LD-2 covering mat formed particleboard with face screw holding of 124 lbs., modulus of rupture of minimum 700 psi and modulus of elasticity of not less than 148,000 psi.

2. Core shall be capable of satisfying this WDMA TM-7 cycle slam test for 1 million slams for surface mounted hardware. Where the manufacturer's core does not meet this criteria, stiles and rails must measure a minimum of 5-1/2" and must be fabricated of hardwood.

    a. Surface mounted hardware must be installed with minimum 1-1/4" screw penetrations using threaded to the head screws; coordinate with Section 087100.

B. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Masonite

2. VT Industries

3. Mohawk

C. Cross Bands: Shall be 1/16" thick hardwood extending full width of door and laid with grain at right angles to face veneers. Cross bands and faces shall be laminated to the core with Type I MF or PVA glue.

D. Stiles, Rails: Stile and rail shall be a minimum of 1-3/8" solid hardwood or structural composite lumber (after trimming) laminated to the core. Stiles and rails must be securely glued to the core with no voids allowed. Stiles and rails must be capable of screw holding of 550 lbs. per WDMA TM-10.

E. Vertical door edge must be capable of screw holding of 550 lbs. per WDMA TM-10; horizontal door edge must be capable of screw holding of 400 lbs. per WDMA TM-10.

F. Doors with transparent finish to have center balanced, slip matched, quarter sliced, Select species as selected by Architect veneer. Veneer to conform to AWI, "AA" grade veneer with 3" wide leaf. Minimum veneer thickness shall be not less than 1/50" after sanding.

1. Veneers shall be continuous or end matched at transoms.

G. Doors shall have hinge loading capacity of 500 lbs. per WDMA TM-8.

H. Where glass lites are noted, factory cut openings. Trim openings with solid hardwood moldings of same type of wood as face veneer. Lite openings in 20 minute rated doors shall have manufacturer's 20 minute approved hardwood system.

I. Doors to be field painted shall have MDO or hardboard face.

2.2 FIRE RATED WOOD DOORS ("B" LABEL)

A. Provide mineral core 1-3/4" thick solid core wood doors conforming to standards specified herein, manufactured by one of the manufacturers noted above. Stile construction on both stiles shall conform to the following:

1. Stile edge screw withdrawals when tested in accordance with ASTM D 1037-78 shall exceed 650 lbs. This applies to both stiles.

2. Stile edge split resistance when tested in accordance with ASTM D 143-52 (78) Modified must exceed 950 lbs. This applies to both stiles.

B. Door to have face finish as specified above in Article 2.1.

1. Where the core is free of urea formaldehyde, provide a layer of veneer over the substrate prior to application of finish veneer to prevent telegraphing of patterns from the adhesive.

C. Blocking: For surface mounted hardware only, provide composite blocking designed to maintain fire resistance of door but with improved screw-holding capability of same thickness as core and with minimum dimensions as follows:

1. 5-inch top rail blocking.

2. 5-inch bottom rail blocking.

3. 1 – 5" x 18" lock block at cylinder or mortise locksets.

4. 2 – 5" x 18" lock blocks at exit devices.

D. Pairs: Provide fire-rated pairs with fire-retardant stiles that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

2.3 SHOP FINISH

A. Transparent Finish: Finish in the shop with clear satin catalyzed polyurethane finish conforming to AWI System "Catalyzed Polyurethane Transparent".

B. Opaque Finish: For doors to be field painted, shop prime on all surfaces with one coat of alkyd wood primer applied to a dry film thickness of 1.5 mils.

2.4 FABRICATION

A. Prefit and premachine wood doors at the factory.

B. Comply with the tolerance requirements specified herein. Machine doors for hardware requiring cutting of doors. Comply with final hardware scheduled and door frame shop drawings, and with hardware templates and other essential information required to ensure proper fit of doors and hardware.

C. Take accurate field measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in the factory.

D. Doors shall be factory sized to door opening so that trimming and fitting are not required in the field.

E. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances unless otherwise indicated.

1. Three degree bevel or bevel to suit frame sizes indicated, with 3/16" prefit in width, +0/-1/32" tolerances. Prefit top of door 1/8" + 1/16"/-0" and undercut as required by floor condition. Undercut shall not exceed 1/8" from bottom of door to top of finished floor; where threshold occurs undercut shall not exceed 1/8" from bottom of door to top of threshold.

2. Comply with requirements in NFPA 80 for fire-rated doors.

F. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3 unless otherwise noted. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2. Provide concealed intumescent seals at fire-rated pairs of doors meeting the requirements of U.L. 10 C.

G. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kinds of doors required.

2.5 SOURCE QUALITY CONTROL

A. Once installed, maximum allowable warp, bow, cut or twist in doors shall be 1/16" as measured by the 1/16 inch feeler gauge and a straight-edge extending from corner to corner of the door face at stiles, top and bottom rails and along both diagonals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Refer to Section 062000 for installation of wood doors.

END OF SECTION

SECTION 082550 - FLUSH FRP DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fiberglass reinforced polyester (FRP) flush doors.

B. Related Sections include the following:

1. Division 8 Section “Door Hardware”.
2. Division 8 Section "Glazing" for glass view panels in flush FRP doors.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.

B. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, finish, options, and accessories.

C. Samples:

1. Door: Submit manufacturer's sample of door showing face sheets, core, framing, finish, options, and accessories.
2. Color: Submit manufacturer's samples of standard colors of doors and frames.

D. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

E. Manufacturer's Project References: Submit list of successfully completed projects including project name and location, name of architect, and type and quantity of doors manufactured.

F. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.

G. Warranty: Submit manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
2. Door and frame components from same manufacturer.

1.5 REFERENCES

A. AAMA 1503.1 - Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

B. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. ASTM D 256 - Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.

E. ASTM D 570 - Water Absorption of Plastics.

F. ASTM D 638 – Tensile Strength of plastics.

G. ASTM D 790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

H. ASTM D1308 – Stain resistance of a product's natural surface

I. ASTM D 2583 - Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

J. ASTM E 84 - Surface Burning Characteristics of Building Materials.

K. ASTM E 283-91 – Air Infiltration

L. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by

M. Uniform Static Air Pressure Difference.

N. ASTM E 331 – Water Resistance

O. SFBC P.A. 203 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

P. SFBC 3603.2 (b) (5) - Forced Entry Resistance Test.

1.6 PERFORMANCE REQUIREMENTS

A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.

B. Air Infiltration: For a single door 3'0" x 7"0", the test specimen shall be tested in accordance with ASTM 283-91 @ pressure differential of 6.24 PSF. Door shall not exceed .90 CFM per linear foot of perimeter crack.

C. Water Resistance: For a single door 3'0" x 7"0", the test specimen shall be tested in accordance with ASTM 331 @ pressure differential of 7.50 PSF. Door shall not have any water leakage.

D. Single door with single point latching:

1. Uniform Static Load, ASTM E330: Plus or minus 75 pounds per square foot.
2. Forced Entry Test, 300 Pound Load Applied, SFBC 3603.2 (b)(5): Passed
3. Cyclic Load Test, SFBC P.A. 203: Plus or minus 53 pounds per square foot.

E. Thermal Transmission, Exterior Doors, U-Value, AAMA 1503.01: Maximum of 0.09 BTU/hr x sf x degrees F.

F. Surface Burning Characteristics, FRP Doors and Panels, ASTM E 84:

1. Flame Spread: Maximum of 170, Class C.
2. Smoke Developed: Maximum of 390, Class C.

G. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E 84:

1. Flame Spread: Maximum of 15.
2. Smoke Developed: Maximum of 310.

H. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 256: 15.0 foot-pounds per inch of notch.

I. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D 638: 14,000 psi.

J. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D 790: 21,000 psi.

K. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.20 percent after 24 hours.

L. Indentation Hardness, FRP Doors and Panels, Nominal Value, ASTM D 2583: 55.

M. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight With CS-17 Wheel: Maximum of 0.029 average weight loss percentage.

N. Stain Resistance, ASTM D1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Superficial change (Stain removed Easily with mild abrasive or FRP cleaner) when exposed to Sharpie, ink pen and white spray paint.

O. Chemical Resistance: ASTM D543. Excellent rating

1. Acetic acid, 5%.
2. Chlorine bleach, 10% solution.
3. Sodium hypochlorite, 4 to 6% solution.
4. Citric acid, 10% solution.
5. Sodium Carbonate Solution, 20%
6. Turpentine

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage during handling and installation.

1.8 WARRANTY

A. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

B. Warranty Period: Ten years starting on date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for each stile and rail door is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

1. Special-Lite, Inc., PO Box 6, Decatur, Michigan 49045
   Toll Free (800) 821-6531 Fax (800) 423-7610. Web Site: www.special-lite.com

2. Or from one of the following manufactures:
   a. Extrudart
   b. Cline

2.2 FRP FLUSH DOORS

A. Basis of design: Model: SL-17 Flush Doors fiberglass reinforced polyester (FRP) face sheets.
B. Basis of Design: Model SL-18 Flush Doors 6 panel wood grain polyester (FRP) face sheets.

C. Door Opening Size: As indicated on the drawings.

D. Construction:

1. Door Thickness: 1-3/4 inches.
2. Stiles and Rails: Aluminum Alloy 6063-T5, minimum of 2-5/16-inch depth.
3. Corners: Mitered.
4. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom as standard tubular shaped stiles and rails reinforced to accept hardware as specified.
5. Securing Internal Door Extrusions: 3/16” angle blocks and hex-type nuts for joinery. Welds, glue, or other methods are not acceptable.
6. Base sheet of 0.032-inch thick aluminum on each face. Foam core shall be fully encapsulated with metal.

7. Furnish extruded stiles and rails with integral reglets to accept face sheet and lock it into place to permit flush appearance.
8. Rail caps or other face sheet capture methods are not acceptable.
9. Extrude top and bottom rail legs for interlocking continuous weather bar.
10. Meeting Stiles: Nylon brush weatherstripping. Extrude meeting stile to include integral pocket to accept nylon brush.
11. Bottom of Door: Install bottom weather bar, with nylon brush weatherstripping, into extruded interlocking edge of bottom rail.

E. Face Sheet:

1. Material: FRP, 0.120-inch thickness, finish color throughout. Abuse-resistant engineered surface.
2. Texture: As selected by Architect from Manufacturer's full range of textures.
3. Color: As selected by Architect from Manufacturer's full range of colors.

F. Base Sheet:

1. Material: 0.032-inch aluminum
2. Color: Match stiles and rails.
3. Base Sheet shall completely encapsulate foam core.

G. Core:

1. Material: Poured-in-place polyurethane foam.
2. Density: Minimum of 5 pounds per cubic foot.
3. R-Value: Minimum of 11.

H. Cutouts:

1. Manufacture doors with cutouts for required vision lites, louvers, and panels.
2. Factory install vision lites, louvers, and panels.

I. Hardware:

1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
2. Factory install hardware, except for door closers and holders that require field installation.

2.3 MATERIALS

A. Aluminum Members:

1. Extrusions: ASTM B 221.
2. Sheet and Plate: ASTM B 209.
3. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.

B. Components: Door and frame components from same manufacturer.

C. Fasteners:

1. Material: Aluminum, nonmagnetic stainless steel, or other noncorrosive metal.

2. Compatibility: Compatible with items to be fastened.
3. Exposed Fasteners: Screws with finish matching items to be fastened.

2.4 FABRICATION

A. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the drawings.

B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.

C. Assembly:

1. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
2. Remove burrs from cut edges.

D. Welding: Welding of doors or frames is not acceptable.

E. Fit:

1. Maintain continuity of line and accurate relation of planes and angles.
2. Secure attachments and support at mechanical joints with hairline fit at contacting members.

2.5 HARDWARE

A. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.

B. Factory install hardware.

C. Hardware Schedule: As specified in Section 08711

D. Finish: As selected by Architect.

2.6 VISION LITES

A. Factory Glazing: 1-inch glass insulating units.

B. Lites in Exterior Doors: Allow for thermal expansion.

C. Rectangular Lites:

1. Size: As indicated on the drawings.
2. Factory glazed with screw-applied aluminum stops anodized to match perimeter door rails.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent utilization of doors. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 INSTALLATION

A. Install doors in accordance with manufacturer's instructions.

B. Install doors plumb, level, square, true to line, and without warp or rack.

C. Anchor frames securely in place.

D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.

E. Set thresholds in bed of mastic and backseal.

F. Install exterior doors to be weathertight in closed position.

G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

H. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 ADJUSTING

A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.5 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.6 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION 08255

SECTION 083113

ACCESS DOORS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the access doors as indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. Floor access door.

2. Oversized fire rated insulated access doors.

3. Frameless recessed panel access doors at drywall ceilings and walls.

4. Framed flush panel access doors at masonry and tile walls.

5. Provide access doors and frames for access from occupied spaces to the following, where indicated or required, and as directed by the trades of Divisions 23 and 26.

a. All shutoff or balancing valves.
b. Fire dampers, as required.
c. Points of duct access.
d. Pull boxes.
e. Controls of mechanical and electrical items.
f. Masonry shafts for pipes and conduits, as required.
g. Pipe spaces, if required.
h. Inlets of fans.
i. Fusible link and splitter damper at filter bank.
j. Automatic damper and motor.
k. Equipment not otherwise accessible.

1.3 RELATED SECTIONS

A. Masonry - Section 042000.

B. Drywall - Section 092900.

C. Ceramic tile - Section 093000.

D. Valves and connections - Division 23.

1.4 QUALITY ASSURANCE

A. For actual installation of the work of this Section, use only personnel who are thoroughly familiar with the manufacturer's recommended methods of installation and who are completely trained in the skills required.

B. Fire-Resistance Ratings: Wherever a fire-resistance classification is shown, or for construction where access doors are installed, provide required access door assembly with panel door, frame, hinge and latch from manufacturers listed in Underwriters' Laboratories, Inc. "Classified Building Materials Index" for the rating shown.

1. Provide UL label on each access panel.

2. Provide flush, key operated cylinder lock.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units which may vary slightly from sizes shown or scheduled.

1.5 SUBMITTALS

A. Before any materials of this Section are delivered to the job site, submit complete manufacturer's literature to the Architect. Submit plans and schedules showing size and location of each and every access door for Architect's acceptance prior to installation.

1.6 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

2.1 FLOOR ACCESS DOORS

A. Basis of Design: The BILCO Company; Type JD-AL H20 Channel Frame Loading Access Door

1. Furnish and install where indicated on plans vault access door Type JD-AL H20, size as indicated on the drawings. Length denotes hinge side. The floor access door shall be single leaf and pre-assembled from the manufacturer.

2. Performance characteristics:

    a. Covers: Reinforced to support a minimum live load of 300 psf (1464 kg/m^2) with a maximum deflection of 1/150th of the span.
    b. Operation of the covers shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
    c. Operation of the covers shall not be affected by temperature.
    d. Entire door, including all hardware components, shall be highly corrosion resistant.

3. Covers: 1/4” (6mm) aluminum diamond pattern.

4. Frame: Channel frame shall be extruded aluminum with bend down anchor tabs around the perimeter.

5. Hinges: Specifically designed for horizontal installation, through bolted to the cover with tamperproof Type 316 stainless steel lock bolts, and through bolted to the frame with Type 316 stainless steel bolts and locknuts.

6. Drain Coupling: Provide a 1-1/2” (38mm) drain coupling located in the right front corner of the channel frame [note: can be placed at a different location if specified].

7. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4” (6mm) gusset support plate.

8. Provide a removable exterior turn/lift handle with a spring loaded ball detent to open the cover. The latch release shall be protected by a flush, gasketed, removable screw plug.

9. Hardware:

    a. Hinges: Heavy forged Type 316 stainless steel hinges, each having a minimum 1/4” (6mm) diameter Type 316 stainless steel pin, shall be provided and shall pivot so the cover does not protrude into the channel frame.

b. Covers shall be equipped with a hold open arm which automatically lock each cover in the open position.
c. Covers shall be fitted with the required number and size of compression spring operators. Springs and spring tubs shall be Type 316 stainless steel.
d. Type 316 stainless steel snap lock with fixed handle mounted on the underside of the covers.
e. Cylindrical lock or removable core.
f. Hardware: Type 316 stainless steel throughout.

10. Factory Finish: Mill finish aluminum with bituminous coating applied to the exterior of the frame.

2.2 OVERSIZED WALL FIRE RATED INSULATED ACCESS DOOR

A. Basis-of-Design: Provide wall 36” x 48” double access model BA-FD2D-36-48 by Best Access Doors.

1. Materials: Galvannealed steel

2. Frame: 16 ga up to and including 30” x 48”. Larger sizes are 14 ga. Removable center mullion (max 48”). Frame Depth 2 1/4”.

3. Wall Trim: 1-1/4” (32mm).

4. Door Panel: 18ga, liner 22ga with slam latch.

5. Insulation: The door panel contains 1 1/2” of high temperature insulation material.

6. Fuel Contribution: 0 Smoke Developed: 0

7. Finishes: Rust-inhibitive off-white prime coat on exterior surface.

8. Hinges: Concealed continuous rod hinge. 48” or longer in wall position will be a continuous piano hinge. Hinge is the “H” dimension.

9. Panel Closer: The automatic panel closer will close and latch the door from an open position of approximately 90° as required by code.

10. Latch: The standard factory installed latch is a flush mount 1/4” allen key. All fire-rated locks are self-latching and include an interior latch release mechanism allowing the doors to be opened from the inside.

2.3 FRAMELESS RECESSED AND FRAMED FLUSH PANEL ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Basis of Design: Milcor Inc.

2. Other Acceptable Manufacturers:

   a. Nystrom Inc.
   b. Karp Associates, Inc.

B. Provide access door assembly as an integral unit complete with all parts and ready for installation.

C. Fabricate units of continuous welded steel construction. Grind welds smooth and flush with adjacent surfaces. Provide attachment devices and fasteners of the type required to secure access panels to the types of supports shown.

D. Frames for Masonry and Tile Wall Only (Flush Panel Units)

1. Fabricate frame from sixteen (16) gauge steel. Provide frame with exposed flange not less than one (1) inch wide around perimeter of frame for the following construction:

   a. Exposed masonry.
   b. Tile finish.

2. For installation in masonry construction, provide frames with adjustable metal masonry anchors.

E. Frameless Units for Drywall Surfaces (Recessed Panel Units): Provide access doors without exposed frames for drywall adhered to recessed panel.

F. Panels: Fabricate from fourteen (14) gauge steel, with concealed spring hinges set to open to 175 degrees. Provide removable pin type hinges of the quantity required to support the access panel sizes used in the work. Finish with manufacturer's factory applied baked enamel prime coat applied over phosphate protective coating on steel.

G. Locking Devices

1. For non-rated access doors, provide flush, screwdriver operated cam locks of number required to hold door in flush, smooth plane when closed.

2. For fire rated doors, provide locks as described in paragraph 1.4, B. herein.

H. Inserts and Anchorage: Furnish inserts and anchoring devices which must be built into masonry for the installation of access panels. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where access doors are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 COORDINATION

A. Coordinate all work with the mechanical trades to ensure proper locations and in a timely manner to permit orderly progress of the total work.

B. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

C. Adjust hardware and panels after installation for proper operation.

D. Remove and replace panels or frames which are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 084113

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the aluminum entrances and storefronts as indicated on the drawings and/or specified herein, including the following:

1. Exterior entrance systems.

2. Exterior storefront systems.

1.3 RELATED SECTIONS

A. Sealants - Section 079200.

B. Aluminum windows - Section 085113.

C. Finish hardware - Section 087100.

D. Glass and glazing - Section 088000.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.

B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of work. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others. Show interfaces and relationships to work of other trades.

C. Field Measurements: Take necessary field measurements before preparation of shop drawings and fabrication. Do not delay progress of job. If field measurements are not possible prior to fabrication, allow for field cutting and fitting.

D. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.

E. Verification Samples: Submit representative samples of each material that is to be exposed in completed work. Show full color ranges and finish variations expected. Provide samples having minimum size of 144 sq. in.

F. Calculations: Provide professionally prepared calculations and certification of performance of this work. Indicate how design requirements for loading and other performance criteria have been satisfied; refer to Article 1.5, para. D for further description.

G. Test Reports: Provide certified test reports for specified tests.

1.5 QUALITY ASSURANCE

A. Source: For each material type required for work of this Section, provide primary materials that are products of one manufacturer. Provide secondary or accessory materials that are acceptable to manufacturers of primary materials.

B. Installer: A firm with a minimum of three years' experience in type of work required by this Section and which is acceptable to manufacturers of primary materials.

C. Design Criteria: Drawings indicate sizes, member spacings, profiles, and dimensional requirements of work of this Section. Minor deviations will be accepted in order to utilize manufacturer's standard products when, in the Architect's sole judgment, such deviations do not materially detract from the design concept or intended performances.

D. Engineering: Provide services of a Professional Engineer, registered in the jurisdiction in which the Project will be built, to design and certify that work of this Section meets or exceeds performance requirements specified.

1.6 TESTS AND PERFORMANCE REQUIREMENTS

A. Manufacturer's Standard Tests: Provide manufacturer's standard test data showing compliance with specified requirements.

B. Testing and performance data applies to exterior assemblies.

C. Test Sequence: Test sequence is optional, except that air infiltration tests shall precede water resistance tests.

D. Air Infiltration Test: Test unit in accordance with ASTM E 283, as follows:

1. Static Air Pressure Difference: 6.24 psf for fixed storefront units, and 1.567 psf for doors.

2. Performance: Maximum air leakage shall not exceed Code requirements.

E. Water Leakage Test: Test fixed framing system in accordance with ASTM E 331.

1. Test Pressure: 6.24 psf.

2. Performance: No leakage as defined in test method at specified test pressure.

F. Uniform Load Deflection Test: Test units in accordance with ASTM E 330, at following static

air pressure difference (Design Wind Pressure), or loads prescribed by code for this project site, whichever is greater. Apply pressure first to exterior side (positive) and then interior side (negative).

1. Design Wind Pressure: ASCE-7 or Building Code, whichever is more restrictive.
2. Test Procedure: Procedure A as specified in ASTM E 330.
3. Performance: Deflection in each member measured at locations of greatest deflection shall not exceed L/175 at specified Design Wind Pressure.

G. Uniform Load Structural Test: Test units in accordance with ASTM E 330 at following static air pressure difference. Apply high-pressure load first on one side and then on other side. At conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or activating mechanisms.

1. Static Air Pressure: Minimum 1.5 times the Design Wind Pressure.
2. Permanent Deformation in Any Member: Not to exceed 0.2% of member span.

H. Condensation Resistance Factor (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:

1. Exterior Storefront: 68 frame and 68 glass (low-e).
2. Exterior Doors: 49 frame and 68 glass (low-e).

I. Thermal Movement: Provide storefront systems that allow for expansion and contraction of members throughout an ambient temperature range of 120 deg F.

J. Seismic Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction or ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 9, "Earthquake Loads," whichever are more stringent.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Store under cover and protect from weather damage.

B. Sequence deliveries to avoid delays but minimize on-site storage.

1.8 WARRANTIES

A. Provide written warranty, signed by manufacturer, agreeing to repair or replace work that exhibits defects in materials or workmanship. "Defects" is defined to include, but not limited to, leakage of water, abnormal aging or deterioration, abnormal deterioration or fading of finishes, and failure to perform as required. Include requirement for removal and replacement of covering and connected adjacent work.

1. Warranty Period: Three (3) years from date of Substantial Completion; except finish shall be warranted for a period of fifteen (15) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/PRODUCTS

A. Exterior Frame System:

1. Basis of Design: Kawneer Company, Inc.; Series 451UT.

2. Other Acceptable Manufacturers:

a. Wausau Metals Corporation.
b. EFCO.
c. Vistawall.

B. Doors for Exterior Application:

1. Basis of Design: Kawneer Company, Inc.; Insulpour 250T Narrow Stile.

2. Other Acceptable Manufacturers:

a. Wausau Metals Corporation.
b. EFCO.
c. Vistawall.

C. Interior Frame System:

1. Basis of Design: Kawneer Company, Inc.; Tri-Fab II 450.

2. Other Acceptable Manufacturers:

a. Wausau Metals Corporation.
b. EFCO.
c. Vistawall.

D. Doors for Interior Application:

1. Basis of Design: Kawneer Company, Inc.; 190 Narrow Stile.

2. Other Acceptable Manufacturers:

a. Wausau Metals Corporation.
b. EFCO.
c. Vistawall.

2.2 MATERIALS AND ACCESSORIES

A. Aluminum Members: Provide 6063-T5 alloy and temper as recommended by manufacturer for strength, corrosion resistance, and application of required finish. Comply with ASTM B 221 for extrusions, and ASTM B 209 for sheet/plate. Provide 0.125" thick extrusions for door stiles and storefront framing. Provide 0.050" thick aluminum for glazing moldings.

B. Fasteners: Provide non-magnetic stainless steel fasteners, warranted by manufacturer to be non-corrosive and compatible with aluminum components.

C. Concealed Flashing: Dead-soft stainless steel, 26 gauge minimum, or extruded aluminum 0.062" minimum, of an alloy and type selected by manufacturer for compatibility with other components.

D. Brackets and Reinforcements: Non-magnetic stainless steel or hot-dip galvanized steel complying with ASTM A 123.

E. Concrete/Masonry Inserts: Cast-iron, malleable iron, or hot-dip galvanized steel complying with ASTM A 123.

F. Bituminous Coatings: Cold-applied asphalt mastic compounded for 30-mil thickness per coat.

G. Compression Weatherstripping: Manufacturer's standard replaceable stripping of molded neoprene or PVC gaskets complying with ASTM D 2287.

H. Sliding Weatherstripping: Manufacturer's standard replaceable stripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing.

2.3 HARDWARE

A. Provide hardware units as indicated, scheduled, or required for operation of each door. Refer to Section 087100, Finish Hardware for hardware description.

2.4 FABRICATION

A. Sizes and Profiles: Required sizes for door and frame units, including profile requirements, are indicated on Drawings. Any variable dimensions are indicated, together with maximum and minimum dimensions required to achieve design requirements and coordination with other work.

B. Prefabrication: To greatest extent possible, complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site. Disassemble components only as necessary for shipment and installation.

1. Preglaze door and frame units to greatest extent possible, in coordination with installation and hardware requirements.

2. Do not drill and tap for surface-mounted hardware items until time of installation at project site.

3. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work in manner which prevents damage to exposed finish surfaces. For hardware, perform these operations prior to application of finishes.

C. Welding: Comply with recommendations of American Welding Society to avoid discoloration; grind exposed welds smooth and restore mechanical finish.

D. Reinforcing: Install reinforcing as necessary for performance requirements; separate dissimilar metals with bituminous paint or other separator to prevent corrosion.

E. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.

F. Fasteners: Conceal fasteners.

G. Provide EPDM/vinyl blade gasket weatherstripping in bottom exterior door rail, adjustable for contact with threshold.

H. At interior doors and other locations without weatherstripping, provide neoprene silencers on stops to prevent metal-to-metal contact.

I. Provisions shall be made in the framing for minimum edge clearance, nominal edge cover, and nominal pocket width for the thickness and type of glazing installed, and shall be in accordance with the FGMA Glazing Manual.

J. Pocket glazed framing shall provide:

		Insulating Glass
1.	Nominal edge cover (or bite) framing only	1/2"
2.	Min. nominal edge clearance	1/4"
3.	Min. face clearance	5/32"

2.5 STOREFRONT FRAMING

A. General: Provide inside-outside matched resilient flush glazed system with provisions for glass replacement. Shop fabricate and preassemble frame components where possible.

B. Thermal-Break Construction: Fabricate exterior aluminum storefront framing system with integrally concealed, low conductance thermal barrier, located between exterior materials and exposed interior members, in manner which eliminates direct metal-to- metal contact. Provide manufacturer's standard construction which has been in use for similar projects for at least three years.

C. For glass and glazing, refer to Section 088000.

2.6 ALUMINUM DOORS

A. Aluminum entrance doors shall be thermally broken narrow stile factory-glazed aluminum doors, manufactured by same manufacturer as storefront framing.

B. Aluminum entrance doors shall be stile and rail type swing doors. Aluminum shall be extruded aluminum conforming to ASTM B 221, 0.125" thick for door stiles and 0.050" thick for glazing molding.

1. Sections shall be of sizes and profiles indicated; shall present straight, sharply defined lines and arrises; and shall be free from defects impairing strength, durability, and appearance.

2. Fasteners where exposed shall be aluminum stainless steel or plated steel conforming to ASTM B 633.

C. Each door shall be factory glazed set in neoprene glazing gasket, refer to Section 088000

for glass.

D. Doors shall meet the following resistance to corner racking when tested by the Dual Moment Load Test.

1. Test section shall consist of a standard top door corner assembly. Side rail section shall be 24" long and top rail section shall be 12" long.

2. Anchor "top rail" positively to test bench so that corner protrudes 3" beyond bench edge.

3. Anchor a lever arm positively to "side rail" at a point 19" from inside edge of "top rail." Attach weight support pad at a point 19" from inner edge of "side rail."

4. Test section shall withstand a load of 235 lbs. on the lever arm before reaching the point of failure, which shall be considered a rotation of the lever arm in excess of 45 deg.

E. For door hardware, refer to Section 087100.

F. Door bottom rail of exterior doors shall have an EPDM blade gasket sweep strip applied with concealed fasteners.

G. Corner construction shall consist of mechanical clip fastening, SIGMA deep penetration and fillet welds. Glazing stops shall be hook-in type with EPDM glazing gaskets.

H. The door weatherstripping on a single acting offset pivot or butt hung exterior door and frame (single or pairs) shall be thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.

I. The door weatherstripping on a double acting, center pivoted door and frame (single or pairs) shall be pile cloth. The door bottom rail shall be weathered with an EPDM blade gasket sweep strip applied with concealed fasteners.

J. The meeting stiles on pairs of doors shall be equipped with an adjustable astragal.

2.7 FINISH

A. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer’s written instructions.

1. Fluoropolymer Two-Coat System: Manufacturer’s standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605-98.

2. Custom color and gloss as selected by the Architect.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where aluminum entrances and storefronts are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install aluminum entrance doors and storefront framing in openings prepared under other Sections plumb, square, level, in exact alignment with surrounding work, with proper clearances, and securely and positively anchored to building structure, to meet performance requirements specified herein, in accordance with manufacturer's published instructions and approved submittals.

B. Use only skilled mechanics for erection, under supervision of manufacturer's representative.

C. Provide protection against galvanic action. Isolate dissimilar materials with bituminous coating or non-absorptive dielectric tape.

D. Install aluminum entrance doors, storefront frame, and finish hardware. Carefully fit and adjust doors and hardware to frames and weatherstripping. After erection check and adjust operating hardware for smooth and proper operation.

E. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Section 079200.

F. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances.

1. Variation from Plane: Limit variation from plane or location shown to 1/8" in 12'-0"; 1/4" over total length.

2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16". Where surfaces meet at corners, limit offset from true alignment to 1/32".

3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8".

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified independent testing agency to perform testing indicated for storefronts.

B. Test fixed frames for water infiltration per AAMA 501.2; latest edition. Test within the first 10% of work complete, area to be a minimum of 100 SF of wall and including a perimeter where frames adjoin adjacent construction. Interior finishes must not interfere with observation of test area or be removed from test area. Not appropriate for operable doors.

1. This test (AAMA 501.2) shall be performed infield on new construction.

C. Repair or remove Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

3.4 PROTECTION AND CLEANING OF ALUMINUM

A. Protect finished metal surfaces from damage during fabrication, shipping, storage, and erection, and from then until acceptance by Owner.

B. Clean metal surfaces promptly after installation, exercising care to avoid damage. Remove excess sealant, dirt, and other substances. Lubricate hardware and other moving parts.

3.5 PROTECTION AND CLEANING OF GLASS

A. Replace glass that is broken, cracked or chipped prior to time of final acceptance of Project by Owner.

B. Clean glass surfaces promptly after installation, exercising care to avoid damage to same.

END OF SECTION

SECTION 087100
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood, aluminum, and hollow metal doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. Lock cylinders for doors with balance of hardware specified in other sections.

E. Thresholds.

F. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames.

B. Section 081116 - Aluminum Doors and Frames.

C. Section 081213 - Hollow Metal Frames.

D. Section 081416 - Flush Wood Doors.

E. Section 281000 - Access Control: Electronic access control devices.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. BHMA A156.1 - Standard for Butts and Hinges 2021.

C. BHMA A156.2 - Bored and Preassembled Locks and Latches 2017.

D. BHMA A156.3 - Exit Devices 2020.

E. BHMA A156.4 - Door Controls - Closers 2019.

F. BHMA A156.8 - Door Controls - Overhead Stops and Holders 2021.

G. BHMA A156.16 - Auxiliary Hardware 2018.

H. BHMA A156.18 - Materials and Finishes 2020.

I. BHMA A156.21 - Thresholds 2019.

J. BHMA A156.25 - Electrified Locking Devices 2018.

K. BHMA A156.26 - Standard for Continuous Hinges 2021.

L. BHMA A156.28 - Recommended Practices For Mechanical Keying Systems 2018.

M. BHMA A156.115 - Hardware Preparation In Steel Doors And Steel Frames 2016.

N. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.

O. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.

P. DHI (KSN) - Keying Systems and Nomenclature 2019.

Q. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

S. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.

U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

V. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting four weeks prior to commencing work of this section; require attendance by affected installers and the following:
   1. Architect.
   2. Installer's Architectural Hardware Consultant (AHC).
   3. Hardware Installer.
   4. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting: with Rowan University Project Manager.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: A detailed listing that includes each item of hardware to be installed on each door.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Comply with DHI (H&S) using door numbering scheme and hardware set numbers as indicated in Contract Documents.
      a. Submit in vertical format.
   3. List groups and suffixes in proper sequence.
   4. Include complete description for each door listed.
   5. Include manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   6. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Include diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).

2. Elevations: Include front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
3. Diagrams: Include point-to-point wiring diagrams that show each device in door opening system with related colored wire connections to each device.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Supplier's qualification statement.

I. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
1. Include manufacturer's parts lists and templates.
2. Bitting List: List of combinations as furnished.

J. Keying Schedule:
1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

K. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

L. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

M. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

1. Closers: Ten years, minimum.
2. Exit Devices: Five years, minimum.
3. Locksets and Cylinders: Ten years, minimum.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Locks: Provide a lock for each door, unless it's indicated that lock is not required.
   1. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's Series. As indicated in hardware sets.
   2. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.
   3. Strikes:
      a. Finish: To match lock or latch.
      b. Curved-Lip Strikes: Provide as standard, with extended lip to protect frame, unless otherwise indicated.
      c. Center Strike At Pairs of Doors: 7/8 inch (22.2 mm) lip.

D. Closers:
   1. Provide door closer on each exterior door, unless otherwise indicated.
   2. Provide door closer on each fire-rated and smoke-rated door.
   3. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.

E. Overhead Stops and Holders (Door Checks).
   1. Provide stop for every swinging door, unless otherwise indicated.
   2. Overhead Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop, unless otherwise indicated.
   3. Overhead stop is not required if a floor or wall stop has been specified for the door.

F. Drip Guards: Provide at head of outswinging exterior doors unless protected by roof or canopy directly overhead.

G. Thresholds:
   1. Exterior Applications: Provide at each exterior door, unless otherwise indicated.

H. Smoke and Draft Control Seals:
   1. Provide gasketing for smoke and draft control doors that complies with local codes, requirements of assemblies tested in accordance with UL 1784.

I. Weatherstripping and Gasketing:
   1. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
   2. Provide door bottom sweep on each exterior door, unless otherwise indicated.

J. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.

K. See Section 281000 for additional access control system requirements.

L. Fasteners:

1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
    a. Aluminum fasteners are not permitted.
    b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
    a. Self-drilling (Tek) type screws are not permitted.
3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
4. Provide wall grip inserts for hollow wall construction.
5. Fire-Resistance-Rated Applications: Comply with NFPA 80.
    a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
    b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 PERFORMANCE REQUIREMENTS

A. Provide door hardware products that comply with the following requirements:
1. Applicable provisions of federal, state, and local codes.
    a. NFPA 101.
2. Accessibility: ADA Standards and ICC A117.1.
3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
4. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
5. Hardware for Smoke and Draft Control Doors: Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
6. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
7. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
8. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

2.03 HINGES

A. Manufacturers: Conventional butt hinges.
1. BEST; dormakaba Group:
2. Or approved equal.

B. Properties:
1. Butt Hinges: As applicable to each item specified.
    a. Standard Weight Hinges: Minimum of two (2) permanently lubricated non-detachable bearings.
    b. Heavy Weight Hinges: Minimum of four (4) permanently lubricated bearings on heavy weight hinges.
    c. Template screw hole locations.
    d. Bearings: Concealed fully hardened bearings.

e. UL 10C listed for fire-resistance-rated doors.

C. Sizes: See Door Hardware Schedule.
1. Hinge Widths: As required to clear surrounding trim.
2. Sufficient size to allow 180 degree swing of door.

D. Finishes: See Door Hardware Schedule.
1. Fully polish hinges; front, back, and barrel.

E. Grades:
1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
2. Comply with BHMA A156.18 Materials and Finishes.

F. Material: Base metal as indicated for each item by BHMA material and finish designation.

G. Types:
1. Butt Hinges: Include full mortise hinges.

H. Options: As applicable to each item specified.

I. Quantities:
1. Butt Hinges: Three (3) hinges per leaves up to 90 inches (2286 mm) in height. Add one (1) for each additional 30 inches (762 mm) in height or fraction thereof.
a. Hinge weight and size unless otherwise indicated in hardware sets:
1) For doors up to 36 inches (914 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.134 inch (3.4 mm) and a minimum of 4-1/2 inches (114 mm) in height.
2) For doors from 36 inches (914 mm) wide up to 42 inches (1067 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.145 inch (3.7 mm) and a minimum of 4-1/2 inches (114 mm) in height.
3) For doors from 42 inches (1067 mm) wide up to 48 inches (1219 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.
4) For doors greater than 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.
2. Continuous Hinges: One per door leaf.

J. Applications: At swinging doors.
1. Provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.

K. Products:
1. Butt Hinges:
a. Ball Bearing, Five (5) Knuckle.

2.04 CONTINUOUS HINGES

A. Manufactures:
1. Best Access
2. Or approved equal.

Geared Continuous Hinges: As applicable to each item specified.
1) Non-handed.
2) Anti-spinning through-fastener.
3) UL 10C listed for fire-resistance-rated doors.

(a) Metal Door Installation: Rated up to 90 minutes.
(b) Wood Door Installation: Rated up to 60 minutes.
4) Sufficient size to permit door to swing 180 degrees

B. Finishes: See Door Hardware Schedule.

2.05 BOLTS

A. Manufacturers:
1. ABH.
2. Or approved equal. .

B. Properties:
1. Dustproof Strikes: For bolting into floor, provide except at metal thresholds.

C. Options:
1. Extension Bolts: In leading edge of door, one bolt into floor, one bolt into top of frame.
2. Lever extensions: Provide for top bolt at oversized doors.

2.06 EXIT DEVICES

A. Manufacturers:
1. Precision Apex 2000 Series
2. Or approved equal.

B. Properties:
1. Actuation: Crossbar.
2. Touchpads: 'T" style metal touchpads and rail assemblies with matching chassis covers end caps.
3. Latch Bolts: Stainless steel deadlocking with 3/4 inch (19 mm) projection using latch bolt.
4. Lever Design: Match project standard lockset trims.
5. Cylinder: Include where cylinder dogging or locking trim is indicated.
6. Strike as recommended by manufacturer for application indicated.
7. Dogging:
a. Non-Fire-Resistance-Rated Devices: Cylinder 1/4 inch (6 mm) hex key dogging.
b. Fire-Resistance-Rated Devices: Manual dogging not permitted.
8. Touch bar assembly on wide style exit devices to have a 1/4 inch (6.3 mm) clearance to allow for vision frames.
9. All exposed exit device components to be of architectural metals and "true" architectural finishes.
10. Handing: Field-reversible.
11. Fasteners on Back Side of Device Channel: Concealed - exposed fasteners not allowed.
12. Vertical Latch Assemblies' Operation: Gravity, without use of springs.

C. Grades: Complying with BHMA A156.3, Grade 1.
1. Provide exit devices tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.

D. Standards Compliance:
1. UL Listed for Panic and Fire for Class II Circuitry.
2. Provide UL (DIR) listed exit device assemblies for fire-resistance-rated doors.
3. Comply with UL 10C.

E. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.
   1. Listed by UL as a Controlled Exit Device (FULA) and Special Locking Arrangements (FWAX) category.

F. Options:
   1. Electrified Devices:
   2. Delayed Egress Devices: Manufacturer's standard for the application.
   3. Internally mounted switch used to signal other components.
   4. Internally mounted switch that monitors the position of the latchbolt.
   5. MLR: Motorized latch retraction.

G. Products:
   1. 2000.

2.07 ELECTRIC STRIKES

A. Manufacturers:
   1. RCI
   2. Or approved equal.

B. Properties:
   1. Provide UL 1034 compliant devices.
   2. Provide UL 10C compliant devices.
   3. Include transformer and rectifier as necessary for complete installation.

C. Installation: Connect electric strikes into fire alarm where non-rated doors are scheduled to release with fire or sprinkler alarm condition.

2.08 LOCK CYLINDERS

A. Manufacturers:
   1. BEST. No Substitution

B. Material:
   1. Manufacturer's standard corrosion-resistant brass alloy.

C. Types: As applicable to each item specified.
   1. Patented small format interchangeable core (SFIC) type cylinders, with seven pin cores.

2.09 CYLINDRICAL LOCKS

A. Manufacturers:
   1. BEST 9K Series. No Substitution

B. Properties:
   1. Mechanical Locks:
      a. Fitting modified ANSI A115.2 door preparation.
      b. Door Thickness Fit: 1-3/8 inches (35 mm) to 2-1/4 inches (57 mm) thick doors.
      c. Construction: Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
         1) Through-bolted anti-rotational studs.
      d. Cast stainless steel latch retractor with roller bearings for exceptionally smooth operation and superior strength and durability.
      e. Bored Hole: 2-1/8 inch (54 mm) diameter.

f. Backset: 2-3/4 inches (70 mm) unless otherwise indicated.
g. Latch: Single piece tail-piece construction.
1) Latchbolt Throw: 9/16 inch (14.3 mm), minimum.
h. Cylinders:
1) Cylinder Core Types: Locks capable of supporting manufacturers' cores, as applicable.
i. Lever Trim:
1) Style: See Door Hardware Schedule.
2) Outside Lever Sleeve: Seamless one-piece construction.
2. Electrified Locks: Same properties as standard locks, and as follows:
a. Function: Electrically locked (Fail Safe) or unlocked (Fail Secure), as indicated for each lock in Door Hardware Schedule.

C. Finishes: See Door Hardware Schedule.
1. Core Faces: Match finish of lockset.

D. Grades: Comply with BHMA A156.2, Grade 1, Series 4000, Operational Grade 1, Extra Heavy Duty.

E. Material: Manufacturer's standard for specified lock.

F. Products: Cylindrical locks, including mechanical and electrified types.
1. 9K (Grade 1).

2.10 DOOR PULLS AND PUSH PLATES

A. Manufacturers:
1. ABH.
2. Or approved equal. .

B. Material: Stainless steel, unless otherwise indicated.

2.11 CLOSERS

A. Manufacturers:
1. BEST EHD9000 Series
2. Or approved equal.

B. Properties:

C. Grades:
1. Closers: Comply with BHMA A156.4, Grade 1.
a. Underwriters Laboratories Compliance:
1) Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.
(a) UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.

D. Installation:
1. Mounting: Includes surface mounted installations.
2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.
3. At outswinging exterior doors, mount closer on interior side of door.
4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

2.12 OVERHEAD STOPS AND HOLDERS

A. Manufacturers:
   1. Architectural Builders Hardware Mfg (ABH)
   2. Or approved equal.

B. Sizes: Manufacturer's standard for the application.

C. Finishes:
   1. Arms and Brackets: Zinc-plated.

D. Grades: As applicable to item specified.
   1. Comply with BHMA A156.8, Grade 1.

2.13 PROTECTION PLATES

A. Manufacturers:
   1. ABH.
   2. Or approved equal. .

B. Properties:
   1. Plates:
      a. Kick Plates: Provide along bottom edge of push side of every wood door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
         1) Size: 10 inches (254 mm) high by 2 inch (51 mm) less door width (LDW) on push side of door.
      b. Mop Plates: Provide along bottom edge of push side of doors to provide protection from cleaning liquids and equipment damage to door surface.
      c. Edges: Beveled-Heavy, on four (4) unless otherwise indicated.
      d. Counter Sunk Screws.

C. Grades: Comply with BHMA A156.6.

D. Material: As indicated for each item by BHMA material and finish designation.
   1. Metal Properties: Stainless steel.
      a. Metal, Standard Duty: Thickness 0.050 inch (1.27 mm), minimum.

E. Installation:
   1. Fasteners: Countersunk screw fasteners

2.14 STOPS AND HOLDERS

A. Manufacturers:
   1. ABH.
   2. Or approved equal.

B. General: Provide overhead stop/holder when wall or floor stop is not feasible.

C. Grades:
   1. Door Holders, Wall Bumpers, and Floor Stops: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.

D. Types:

2.15 THRESHOLDS

A. Manufacturers:
   1. National Guard Products

2. Or approved equal.

B. Properties:
   1. Threshold Surface: Fluted horizontal grooves across full width.

C. Grades: Thresholds: Comply with BHMA A156.21.

D. Material: Base metal as indicated for each item by BHMA material and finish designation.

E. Types: As applicable to project conditions. Provide barrier-free type at every location where specified.
   1. Saddle Thresholds: Without thermal break.
   2. Bumper Seal Thresholds with Gasket: Use silicone gaskets.

2.16 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
   1. National Guard Products.
   2. Or approved equal.

B. Products:
   1. Weatherstripping: See Door Hardware Schedule.
   2. Smoke Seals: See Door Hardware Schedule.
   3. Meeting Stile Seals: See Door Hardware Schedule.
   4. Door Bottom Seals:
      a. Door Sweeps: See Door Hardware Schedule.

2.17 KEYS AND CORES

A. Manufacturers:
   1. BEST, No Substitution

B. Properties: Complying with guidelines of BHMA A156.28.
   1. Provide small format interchangeable core.
   2. Provide Patented CORMAX keys and cores.
   3. Provide keying information in compliance with DHI (KSN) standards.
   4. Keying Schedule: Arrange for a keying meeting, with Architect, Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying complies with project requirements.
   5. Keying: Master keyed.
   6. Include construction keying and control keying with Brass removable core cylinders.
   7. Supply keys in following quantities:
      a. Grand Master Keys: 2 each.
      b. Master Keys: 4 each each group.
      c. Construction Master Keys: 4 each.
      d. Construction Control Keys: 2 each.
      e. Perm Core Control Keys: 4 each.
      f. Change Keys: 2 each change keys for each keyed core.
   8. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
   9. Include installation of permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Correct all defects prior to proceeding with installation.

C. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware using the manufacturer’s fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

D. Install hardware for smoke and draft control doors in accordance with NFPA 105.

E. Use templates provided by hardware item manufacturer.

F. Do not install surface mounted items until application of finishes to substrate are fully completed.

G. Wash down masonry walls and complete painting or staining of doors and frames.

H. Complete finish flooring prior to installation of thresholds.

I. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014000 - Quality Requirements.

3.04 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation activities.

3.05 PROTECTION

A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

Manufacturer list

ABH	Architectural Builders Hardware
BES	BEST
PRE	BEST (Precision)
BRN	Burns Manufacturing
NGP	National Guard Products
RCI	Rutherford Controls Inc
SCH	Schlage
SEL	SELECT
	Special Lite

Finish list

Code:	Name:
SIA	Slick It Ain't
689	689 Aluminum
CL	Clear
US26D	Satin Chrome
Gray	#N/A
613	Oxidized satin bronze, oil rubbed
CL	Clear
626	Satin chromium plated
S	Silver
US27	Mill Aluminum
A	Anodized Aluminum
US28	Clear Anodized Aluminum
630	Satin Stainless Steel
600	Primed
C	Charcoal

Specification Report

Set #1 - Ext FRP x New ALF - Card Access - Remote Release - Auto Operator

Doors: 108

1.0	Continuous Hinge	SL11 HD	CL	SEL
1.0	Exit Device	2103 LD CA-03	630	PRE
1.0	Rim Cylinder	12E 7 PATD RP	626	BES
1.0	Pull Handle	AB3331 36" 12HD	US32D	ABH
1.0	Electric Strike	0162 LM	32D	RCI
1.0	Auto Operator	PROVIDED BY SECTION 087113		
1.0	Overhead Concealed Stop	1020SL Series	US32D	ABH
2.0	Actuator	946 HP 475 MO	32D	RCI
1.0	Card Reader	By Rowan Univ IRT		
1.0	Door Position Switch	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
1.0	Door Sweep	1015V LAR	US27	NGP
1.0	Threshold	8533V LAR (1/4-20 SS MS/EA)	A SIA	NGP

NOTE: Balance of weather-stripping by Aluminum Frame manufacturer. Coordinate hardware with Aluminum Frame manufacturer. Operation: Presentation of valid credential to card reader or Remote Release (by others) releases electric strike, then enables exterior actuator allowing manual entry or automatic operation. Lobby side actuator always enabled - When pressed exit device latchbolt retracts then cycles automatic operator allowing egress. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Egress always allowed. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #2 - Lobby - Exist Opng

Doors: 108.1

3.0	Interchangeable Core	1CX-7 PATD	626	BES
1.0	Card Reader	By Rowan Univ IRT		

NOTE: Verify hardware with existing.

Set #3 - Ext FRP x ALF SGL - Card Access

Doors: 100.12, 100.16

1.0	Continuous Hinge	SL11 HD	CL	SEL
1.0	Exit Device	2103 LD CA-03	630	PRE
1.0	Rim Cylinder	12E 7 PATD RP	626	BES
1.0	Pull	AB201 12HD Mtg 12"	US32D	ABH
1.0	Electric Strike	0162 LM	32D	RCI

1.0	Door Closer	EHD90 16 SDS90 DP90 BSHD NFHD90	689	BES
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
1.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
1.0	Door Sweep	1015V LAR	US27	NGP
1.0	Threshold	8533V LAR (1/4-20 SS MS/EA)	A SIA	NGP

NOTE: Balance of weather-stripping by Aluminum Frame manufacturer. Coordinate hardware with Aluminum Frame manufacturer. Operation: Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Egress always allowed. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #3B - Ext FRP x ALF - Card Access

Doors: 100. 17

2.0	Continuous Hinge	SL11 HD	CL	SEL
1.0	Flushbolt	1855P	US26D	ABH
1.0	Dust Proof Strike	1870	US32D	ABH
1.0	Removeable Mullion	SL-60E K Special-Lite		
1.0	Exit Device	2103 LD CA-03	630	PRE
1.0	Rim Cylinder	12E 7 PATD RP	626	BES
1.0	Mortise Cylinder	1E 7 4 C181 PATD	626	BES
1.0	Pull	AB201 12HD Mtg 12"	US32D	ABH
1.0	Electric Strike	0162 LM	32D	RCI
1.0	Door Closer	EHD90 16 DS90 DP90 BSNFHD90	689	BES
1.0	Overhead Stop	9020 Series	US32D	ABH
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
2.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
2.0	Door Sweep	1015V LAR	US27	NGP
1.0	Threshold	8533V LAR (1/4-20 SS MS/EA)	A SIA	NGP

NOTE: Balance of weather-stripping by Aluminum Frame manufacturer. Coordinate hardware with Aluminum Frame manufacturer. Operation: Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Egress always allowed. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #3A - Ext FRP x ALF - Card Access

Doors: 102.2

2.0	Continuous Hinge	SL11 HD	CL	SEL

1.0	Flushbolt	1855P	US26D	ABH
1.0	Dust Proof Strike	1870	US32D	ABH
1.0	Removeable Mullion	SL-60E K Special-Lite		
1.0	Exit Device	2103 LD CA-03	630	PRE
1.0	Rim Cylinder	12E 7 PATD RP	626	BES
1.0	Mortise Cylinder	1E 7 4 C181 PATD	626	BES
1.0	Pull	AB201 12HD Mtg 12"	US32D	ABH
1.0	Electric Strike	0162 LM	32D	RCI
1.0	Door Closer	EHD90 16 DST90 DP90 BSNFHD90	689	BES
1.0	Overhead Hold Open	9010 Series	US32D	ABH
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
2.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
2.0	Door Sweep	1015V LAR	US27	NGP
1.0	Threshold	8533V LAR (1/4-20 SS MS/EA)	A SIA	NGP

NOTE: Balance of weather-stripping by Aluminum Frame manufacturer. Coordinate hardware with Aluminum Frame manufacturer. Operation: Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Egress always allowed. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #4 - Ext FRP x ALF - Card Access

Doors: 100.8

2.0	Continuous Hinge	SL11 HD	CL	SEL
1.0	Removeable Mullion	SL-60E K Special-Lite		
1.0	Exit Device	2101 LD	630	PRE
1.0	Exit Device	2103 LD A 1703	630	PRE
1.0	Rim Cylinder	12E 7 PATD RP	626	BES
1.0	Mortise Cylinder	1E 7 4 C181 PATD	626	BES
1.0	Electric Strike	0162 LM	32D	RCI
1.0	Door Closer	EHD90 16 SDS90 DP90 NFHD90 BSHD90	689	BES
1.0	Door Closer	EHD90 16 DS90 DP90 BSNFHD90	689	BES
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
2.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
2.0	Door Sweep	1015V LAR	US27	NGP
1.0	Threshold	8533V LAR (1/4-20 SS MS/EA)	A SIA	NGP

NOTE: Balance of weather-stripping by Aluminum Frame manufacturer. Coordinate hardware with Aluminum Frame manufacturer. Operation: Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Egress always allowed. Coordinate wiring / installation with GC / EC /

Security Vendor.

Set #5 - Ext FRP x Exist FR - Card Access

Doors: 125

2.0	Continuous Hinge	SL52 HD	CL	SEL
1.0	Keyed Removeable Mullion	KR822 MCS	600	PRE
1.0	Exit Device	MLR 2103	630	PRE
1.0	Exit Device	2101	630	PRE
2.0	Rim Cylinder	12E 7 PATD RP	626	BES
1.0	Pull	AB201 12HD Mtg 12"	US32D	ABH
2.0	Door Closer	EHD90 16 SDS90 DP90 BSHD NFHD90	689	BES
1.0	Door Loop	9509 18S	S	RCI
1.0	Card Reader	By Rowan Univ IRT		
2.0	Door Position Switch	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
2.0	Door Sweep	1015V LAR	US27	NGP
1.0	Threshold	8533V LAR (1/4-20 SS MS/EA)	A SIA	NGP

NOTE: Verify new hardware with existing Frame. Patch, Prep and modify existing Frame as required by GC. All modifications must comply with code requirements. and fire ratings where rated. Fill or patch all remaining holes or preps as required. Operation: Presentation of valid credential to card reader retracts exit device latchbolt allowing authorized entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Egress always allowed. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #6 - Office

Doors: 106A, 106B, 1O6C, 106D, 106E, 106F, 106G, 211A, 213A, 207A, 206B, 208B, 3O6B, 306C, 305A, 305B, 305C, 306A, 306D, 105A, 110B, 110C, 110D, 210A, 210B, 212A, 212B, 214A, 301A, 3O1B, 105B, 105C, 105D, 302C, 306E, 306F

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 AB 15 D S3 PATD	626	BES
1.0	Wall Stop	AB403	US26D	ABH
3.0	Silencer	500	Gray	BRN

Set #7 - Office, Mail/Print/Fax

Doors: 305D

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 AB 15 D S3 PATD	626	BES
1.0	Overhead Concealed Stop	1020SL Series	US32D	ABH

3.0	Silencer	500	Gray	BRN

Set #8 - Conference

Doors: 110A, 301C

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 R 15 D S3 PATD	626	BES
1.0	Wall Stop	AB400	626	ABH
3.0	Silencer	500	Gray	BRN

Set #9 - Elev Passage - HMD x HMF

Doors: 109, 215, 303

6.0	Hinge	FBB168 45X45	26D	BES
1.0	Exit Device	FL 2201 LBR	630	PRE
1.0	Exit Device	FL 2214 LBR 4914 A	630	PRE
1.0	Door Closer	EHD90 16 DS90	689	BES
1.0	Door Closer	EHD90 16 SDS90	689	BES
2.0	Protection Plate	PP0050 10" x 1" LDW	US32D	ABH
1.0	Gasketing	5070 Meeting Stile Astragal	CL	NGP
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #10 - Toilet - WD x HMF

Doors: 1O9A

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Mortise Lock	45H 0 LT VIBE O indicator	626	BES
1.0	Door Closer	EHD90 16 IS90	689	BES
1.0	Protection Plate	PP0050 10" x 1" LDW	US32D	ABH
1.0	Protection Plate	PP0050 1" LDW 6" x	US32D	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #11 - Phone Booth - WD x HMF

Doors: 215A

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Mortise Lock	45H 0 LT VIBE O indicator	626	BES
1.0	Door Closer	EHD90 16 DS90	689	BES
1.0	Protection Plate	PP0050 10" x 1" LDW	US32D	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #12 - Elec

Doors: 1O9C

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 D 15 D S3 PATD	626	BES
1.0	Door Closer	EHD90 16 AF90	689	BES
2.0	Protection Plate	PP0050 10" x 1" LDW	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #13 - Toilet

Doors: 215C

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Mortise Lock	45H 0 LT VIBE O indicator	626	BES
1.0	Door Closer	EHD90 16 AF90	689	BES
1.0	Protection Plate	PP0050 10" x 1" LDW	US32D	ABH
1.0	Protection Plate	PP0050 1" LDW 6" x	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #14 - Elec

Doors: 215D

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 D 15 D S3 PATD	626	BES
1.0	Door Closer	EHD90 16 AF90	689	BES
2.0	Protection Plate	PP0050 10" x 1" LDW	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #15 - Cafe

Doors: 303B

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 R 15 D S3 PATD	626	BES
1.0	Door Closer	EHD90 16 AF90	689	BES
2.0	Protection Plate	PP0050 10" x 1" LDW	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #16 - Elec

Doors: 3O3C

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 D 15 D S3 PATD	626	BES
1.0	Door Closer	EHD90 16 DS90	689	BES
2.0	Protection Plate	PP0050 10" x 1" LDW	US32D	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #17 - Corr, Stair - Card Access

Doors: 100.7, 100.12A

3.0	Hinge	FBB168 NRP 45X45	26D	BES
1.0	Exit Device	FL 2103 A 4903	630	PRE
1.0	Rim Cylinder	12E 7 PATD RP	626	BES
1.0	Electric Strike	0162 F LM	32D	RCI
1.0	Door Closer	EHD90 16 SPA90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
1.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

NOTE: Operation: Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Egress always allowed. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #18 - Corr / Corr - Card Access

Doors: 100.10, 100.13, 200.2

6.0	Hinge	FBB168 NRP 45X45	26D	BES
1.0	Exit Device	C FL MLR 2203 LBR 4903 A FSE	630	PRE
1.0	Exit Device	FL 2201 LBR	630	PRE
1.0	Rim Cylinder	12E 7 PATD RP	626	BES
2.0	Door Closer	EHD90 16 SDS90	689	BES
2.0	Protection Plate	PP0050 10" x 1" LDW	US32D	ABH
1.0	Power Transfer	EPT-12C		PRE
1.0	Wiring Harness	WH-192P		BES
1.0	Wiring Harness	WH-6E		BES
1.0	Card Reader	By Rowan Univ IRT		

1.0	Power Supply	By Rowan Univ IRT		
2.0	Door Position Switch	By Rowan Univ IRT		
1.0	Gasketing	5070 Meeting Stile Astragal	CL	NGP
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

NOTE: Door 100.13 Not Fire Rated, remove rating from exit devices. Operation: Presentation of valid credential to card reader retracts exit device latchbolt allowing authorized entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Egress always allowed. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #19 - Shared Kitchen

Doors: 107

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 R 15 D S3 PATD	626	BES
1.0	Door Closer	EHD90 16 IS90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
3.0	Silencer	500	Gray	BRN

Set #20 - Exist Opening - New Core

Doors: 117, 109D, 100.2, 100.3, 1O0A, 1O0B, 100.5, 100.6, 100.9, 205, 207B, 2O7C, 213B, 300, 300A, 307, B01.3, BO1.2, BO5, B02, B04A, BO3, B14, B13.2, 123, 119, 118, 120, 100.18, 100.19, 100.20, 121, 203.1, 203, 200, 201A, 201B, 202, 211.1, 214.1, 104, B05.1

1.0	Interchangeable Core	1CX-7 PATD	626	BES

NOTE: Verify new hardware with existing lock and meet code compliant conditions. Verify in the field quantity of needed cores. Balance of hardware to remain.

Set #22 - Training Room - Card Access

Doors: 103.2

3.0	Hinge	FBB168 NRP 45X45	26D	BES
1.0	Exit Device	FL 2103 A 4903	630	PRE
1.0	Rim Cylinder	12E 7 PATD RP	626	BES
1.0	Electric Strike	0162 F LM	32D	RCI
1.0	Door Closer	EHD90 16 SPA90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
2.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

NOTE: Operation: Presentation of valid credential to card reader releases electric strike allowing

authorized entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Egress always allowed. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #23 - Exist Opening - New Core

Doors: 206, 207, 208, 209, 210, 211, 212, 213, 214, 216, 301.1, 302.1, 304, 305, 306, 306.2, 306.1, 301, 302, 103.1

2.0	Interchangeable Core	1CX-7 PATD	626	BES

NOTE: Verify new hardware with existing lock and meet code compliant conditions. Verify in the field quantity of needed cores. Balance of hardware to remain.

Set #24 - Scene Shop WD x New FR - Card Access

Doors: 102. 1

3.0	Hinge	FBB168 NRP 45X45	26D	BES
1.0	Exit Device	FL 2103 4903 A FSE	630	PRE
1.0	Rim Cylinder	12E 7 PATD RP	626	BES
1.0	Electric Strike	0162 F LM	32D	RCI
1.0	Door Closer	EHD90 16 DS90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Card Reader	By Rowan Univ IRT		
1.0	Door Position Switch	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

NOTE: Operation: Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Egress always allowed. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #25 - Toilet - WD x HMF

Doors: 100D, 100E

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Mortise Lock	45H 0 LT VIBE O indicator	626	BES
1.0	Door Closer	EHD90 16 AF90	689	BES
1.0	Protection Plate	PP0050 10" x 1" LDW	US32D	ABH
1.0	Protection Plate	PP0050 1" LDW 6" x	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #26 - Toilet Corr - Mag Holder

Doors: 100.22

3.0	Hinge	FBB179 NRP 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 R 15 D S3 PATD	626	BES
1.0	Door Closer	EHD90 16 SPA90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Magnetic Door Holder	2300	US28	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

NOTE: Door normally held open by surface wall magnetic holder. In the event of power loss or activation of building fire alarm system door will close and latch. Free egress at all times. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #27 - Exist Dr x Exist Frame - New Card Access

Doors: 100.4

1.0	Interchangeable Core	1CX-7 PATD	626	BES
1.0	Door Closer	EHD90 16 SDS90	689	BES
1.0	Card Reader	By Rowan Univ IRT		

NOTE: Verify new hardware with existing and meet code compliant conditions. Verify in the field quantity of needed cores. Balance of hardware to remain.

Set #28 - Exist Dr x Exist Frame - New Card Access

Doors: 122, 124

1.0	Interchangeable Core	1CX-7 PATD	626	BES
1.0	Electric Strike	0163 LM	32D	RCI
1.0	Card Reader	By Rowan Univ IRT		

NOTE: Verify new hardware with existing and meet code compliant conditions. Verify in the field quantity of needed cores. Balance of hardware to remain.

Set #29 - Exist Dr x Exist Frame - New Card Access

Doors: 100.21

1.0	Interchangeable Core	1CX-7 PATD	626	BES
1.0	Card Reader	By Rowan Univ IRT		

NOTE: Verify new hardware with existing lock and meet code compliant conditions. Verify in the field quantity of needed cores. Balance of hardware to remain.

Set #30 - Existing to Remain

Doors: 100. 14, 100.15, 100.11

NOTE: Existing to remain. Adjust all existing hardware as needed and to meet code compliant condition.

Set #31 - Exist Door & Frame - New Wireless Locks

Doors: 111, 110, 113, 105, 106, 106. 1

1.0	Wireless Lock	Wireless Mort/Cyl Lock LEBMB 06/NDEBBD as Req By Rowan University	626	SCH
1.0	Interchangeable Core	1CX-7 PATD	626	BES

NOTE: Mortise locks or cylindrical locks as determined and supplied by others. Verify new hardware with existing Frame / Door. Patch, Prep and modify existing Frame as required by GC. All modifications must comply with code requirements. and fire ratings where rated. Fill or patch all remaining holes or preps as required. Verify necessary template information to ensure correct / accurate machining / preparation of existing doors and frames.

Set #32 - IDF - New Door & Exist Frame - Wireless Locks

Doors: 116

3.0	Hinge	FBB179 NRP 45X45	26D	BES
1.0	Wireless Lock	Wireless Mort/Cyl Lock LEBMB 06/NDEBBD as Req By Rowan University	626	SCH
1.0	Interchangeable Core	1CX-7 PATD	626	BES
1.0	Door Closer	EHD90 16 DS90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

NOTE: Mortise locks or cylindrical locks as determined and supplied by others. Verify new hardware with existing Frame. Patch, Prep and modify existing Frame as required by GC. All modifications must comply with code requirements. and fire ratings where rated. Fill or patch all remaining holes or preps as required. Verify necessary template information to ensure correct / accurate machining / preparation of existing doors and frames.

Set #33 - Music, MDF, IDF - New Door & Exist Frame - Wireless Locks

Doors: 100.1, 101, 109B

3.0	Hinge	FBB179 NRP 45X45	26D	BES
1.0	Wireless Lock	Wireless Mort/Cyl Lock LEBMB 06/NDEBBD as Req By Rowan University	626	SCH
1.0	Interchangeable Core	1CX-7 PATD	626	BES

1.0	Door Closer	EHD90 16 SPA90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

NOTE: Mortise locks or cylindrical locks as determined and supplied by others. If existing, Verify new hardware with existing Frame . Patch, Prep and modify existing Frame as required by GC. All modifications must comply with code requirements. and fire ratings where rated. Fill or patch all remaining holes or preps as required. Verify necessary template information to ensure correct / accurate machining / preparation of existing doors and frames.

Set #34 - Mail/Copy

Doors: 209A

3.0	Hinge	FBB179 NRP 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 R 15 D S3 PATD	626	BES
1.0	Door Closer	EHD90 16 DS90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #35 - Conf - WD x Exist Frame

Doors: 217

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 IN 15 D S3 PATD	626	BES
1.0	Door Closer	EHD90 16 AF90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Wall Stop	AB403	US26D	ABH
3.0	Silencer	500	Gray	BRN

NOTE: Verify new hardware with existing Frame. Patch, Prep and modify existing Frame as required by GC. All modifications must comply with code requirements. and fire ratings where rated. Fill or patch all remaining holes or preps as required.

Set #36 - Future Finance

Doors: 219

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 AB 15 D S3 PATD	626	BES
1.0	Door Closer	EHD90 16 IS90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
3.0	Silencer	500	Gray	BRN

Set #37 - Stair - Card Access - El Trim Fail Safe

Doors: 200.1

3.0	Hinge	FBB168 NRP 45X45	26D	BES
1.0	Exit Device	C E FL 2103 A 4903 FS	630	PRE
1.0	Rim Cylinder	12E 7 PATD RP	626	BES
1.0	Door Closer	EHD90 16 SPA90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Power Transfer	EPT-12C		PRE
1.0	Wiring Harness	WH-192P		BES
1.0	Wiring Harness	WH-6E		BES
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
1.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

NOTE: New Door and Frame. Door normally closed and locked. Presenting valid credential to card reader releases secure lever allowing authorized entry. Free egress at all times. Tied into building fire alarm system. In the event of loss of power or activation of building fire alarm system, electrified trim of exit device to unlock allowing entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #38 - Stair - Card Access - El Trim Fail Safe

Doors: 200.6

6.0	Hinge	FBB168 NRP 45X45	26D	BES
1.0	Exit Device	C E FL 2203 LBR 4903 A FS	630	PRE
1.0	Exit Device	FL 2201 LBR	630	PRE
1.0	Rim Cylinder	12E 7 PATD RP	626	BES
2.0	Door Closer	EHD90 16 SDS90	689	BES
2.0	Protection Plate	PP0050 10" x 1" LDW	US32D	ABH
1.0	Power Transfer	EPT-12C		PRE
1.0	Wiring Harness	WH-192P		BES
1.0	Wiring Harness	WH-6E		BES
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
1.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
1.0	Gasketing	5070 Meeting Stile Astragal	CL	NGP
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

NOTE: Doors normally closed and locked. Presenting valid credential to card reader releases secure lever allowing authorized entry. Free egress at all times. Tied into building fire alarm system. In the event of loss of power or activation of building fire alarm system, electrified trim of exit device to

unlock allowing entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #39 - Jan, Storage - Exist Opng

Doors: 308, 300B

1.0	Cylindrical Lock	9K 3 7 D 15 D S3 PATD	613	BES
1.0	Wall Stop	AB400	626	ABH
1.0	Wrap-Around	Don-Jo (As Req'd) 10B		

NOTE: Verify finish and hardware with existing Frame/Door., adjust as needed. Patch, Prep and modify existing Frame/Door as required by GC. All modifications must comply with code requirements. and fire ratings where rated. Fill or patch all remaining holes or preps as required.

Set #40 - Stair - Card Access Fail Safe -Exist Opng

Doors: 300.2, 300.1, 200.3, 200.4

1.0	Elec Trim	690F Fail Safe 626 Accentra		
1.0	Blank Trim	620F 626 Accentra		
1.0	Wire Harness	WH-11 Accentra		
1.0	Door Loop	9509 18S	S	RCI
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		

NOTE: Verify new hardware with existing Frame. Patch, Prep and modify existing Frame as required by GC. All modifications must comply with code requirements. and fire ratings where rated. Fill or patch all remaining holes or preps as required. Operation: Doors normally closed and locked. Presenting valid credential to card reader releases secure lever allowing authorized entry. Free egress at all times. Tied into building fire alarm system. In the event of loss of power or activation of building fire alarm system, electrified trim of exit device to unlock allowing entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #41 - Stair - HMD x HMF UL

Doors: B01.1

6.0	Hinge	FBB168 45X45	26D	BES
1.0	Exit Device	FL 2201 LBR	630	PRE
1.0	Exit Device	FL 2214 LBR 4914 A	630	PRE
2.0	Door Closer	EHD90 16 SPA90	689	BES
2.0	Protection Plate	PP0050 10" x 1" LDW	US32D	ABH
2.0	Wall Stop	AB400	626	ABH
1.0	Gasketing	5070 Meeting Stile Astragal	CL	NGP
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #42 - Storage - Card Access

Doors: B08

3.0	Hinge	FBB168 NRP 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 D 15 D S3 PATD	626	BES
1.0	Electric Strike	F2164 F2LM	32D	RCI
1.0	Door Closer	EHD90 16 SPA90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
1.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
3.0	Silencer	500	Gray	BRN

NOTE: Operation: Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Egress always allowed. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #43 - Storage - Card Access

Doors: B07, B06

3.0	Hinge	FBB179 NRP 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 D 15 D S3 PATD	626	BES
1.0	Electric Strike	F2164 F2LM	32D	RCI
1.0	Door Closer	EHD90 16 SPA90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
1.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
3.0	Silencer	500	Gray	BRN

NOTE: Operation: Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Rowan University Security Vendor. Mechanical key bypass. Egress always allowed. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #44 - Fire Pump

Doors: B04B

3.0	Hinge	FBB179 NRP 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 D 15 D S3 PATD	626	BES
1.0	Door Closer	EHD90 16 SDS90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH

1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #45 - Ext FRP x Exist FR

Doors: B13. 1, B17

1.0	Continuous Hinge	SL52 HD	CL	SEL
1.0	Cylindrical Lock	9K 3 7 D 15 D S3 3/4" PATD	626	BES
1.0	Door Closer	EHD90 16 DS90	689	BES
1.0	Door Position Switch	By Rowan Univ IRT		
1.0	Gasketing	700N Head & Jambs (2)	A	NGP
1.0	Door Sweep	1015V LAR	US27	NGP
1.0	Threshold	8533V LAR (1/4-20 SS MS/EA)	A SIA	NGP

NOTE: Verify new hardware with existing Frame. Patch, Prep and modify existing Frame as required by GC. All modifications must comply with code requirements. and fire ratings where rated. Fill or patch all remaining holes or preps as required. Request to Exit by Rowan University Security Vendor. Egress always allowed. Coordinate wiring / installation with GC / EC / Security Vendor.

Set #46 - Event Storage - Card Access – Wireless Lock - New WD x HMF

Doors: 100C

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Wireless Lock	Wireless Mort/Cyl Lock LEBMB 06/NDEBBD as Req By Rowan University	626	SCH
1.0	Interchangeable Core	1CX-7 PATD	626	BES
1.0	Door Closer	EHD90 16 AF90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
1.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
3.0	Silencer	500	Gray	BRN

NOTE: Mortise locks or cylindrical locks as determined and supplied by others. Verify necessary template information to ensure correct / accurate machining / preparation of existing doors and frames.

Set #47 - Office

Doors: 2O6A, 208A

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 AB 15 D S3 PATD	626	BES
1.0	Overhead Concealed Stop	1020SL Series	US32D	ABH

3.0	Silencer	500	Gray	BRN

Set #48 - IDF - Card Access -Wireless Lock

Doors: 215B

3.0	Hinge	FBB179 45X45	26D	BES
1.0	Wireless Lock	Wireless Mort/Cyl Lock LEBMB 06/NDEBBD as Req By Rowan University	626	SCH
1.0	Interchangeable Core	1CX-7 PATD	626	BES
1.0	Door Closer	EHD90 16 AF90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
1.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		
3.0	Silencer	500	Gray	BRN

NOTE: Mortise locks or cylindrical locks as determined and supplied by others. Verify necessary template information to ensure correct / accurate machining / preparation of existing doors and frames.

Set #49 - Office

Doors: 302A, 302B

3.0	Hinge	FBB179 NRP 45X45	26D	BES
1.0	Cylindrical Lock	9K 3 7 AB 15 D S3 PATD	626	BES
1.0	Overhead Concealed Stop	1020SL Series	US32D	ABH
3.0	Silencer	500	Gray	BRN

Set #50 - IDF - Card Access – Wireless Lock - New WD x HMF

Doors: 303A

3.0	Hinge	FBB179 NRP 45X45	26D	BES
1.0	Wireless Lock	Wireless Mort/Cyl Lock LEBMB 06/NDEBBD as Req By Rowan University	626	SCH
1.0	Interchangeable Core	1CX-7 PATD	626	BES
1.0	Door Closer	EHD90 16 SPA90	689	BES
1.0	Protection Plate	PP0050 10" x 2" LDW	US32D	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Card Reader	By Rowan Univ IRT		
1.0	Power Supply	By Rowan Univ IRT		
1.0	Door Position Switch	By Rowan Univ IRT		
1.0	Wiring Diagram	FURNISHED BY HWDE SUPPLIER		

3.0 Silencer	500	Gray	BRN

NOTE: Mortise locks or cylindrical locks as determined and supplied by others. Verify necessary template information to ensure correct / accurate machining / preparation of existing doors and frames.

Set #51

Doors: 108A

1.0 Interchangeable Core	1CX-7 PATD	626	BES

Opening List

Opening:	Hardware Set Assignment:
B01.1	41 - Stair - HMD x HMF UL
BO1.2	20 - Exist Opening - New Core
B02	20 - Exist Opening - New Core
BO3	20 - Exist Opening - New Core
B04A	20 - Exist Opening - New Core
B04B	44 - Fire Pump
BO5	20 - Exist Opening - New Core
B07	43 - Storage - Card Access
B08	42 - Storage - Card Access
B06	43 - Storage - Card Access
B01.3	20 - Exist Opening - New Core
B13. 1	45 - Ext FRP x Exist FR
B13.2	20 - Exist Opening - New Core
B14	20 - Exist Opening - New Core
B17	45 - Ext FRP x Exist FR
1O0A	20 - Exist Opening - New Core
1O0B	20 - Exist Opening - New Core
1O0C	46 - Event Storage - Card Access - New WD x HMF
1O0D	25 - Toilet - WD x HMF
1O0E	25 - Toilet - WD x HMF
100.1	33 - Music, MDF, IDF - New Door & Exist Frame - Wireless Locks
100.2	20 - Exist Opening - New Core
100.3	20 - Exist Opening - New Core
100.4	27 - Exist Dr x Exist Frame - New Card Access

100.5	20 - Exist Opening - New Core
100.6	20 - Exist Opening - New Core
100.7	17 - Corr, Stair - Card Access
100.8	4 - Ext FRP x ALF - Card Access
100.9	20 - Exist Opening - New Core
100.10	18 - Corr / Corr - Card Access
100.11	30 - Existing to Remain
100.12	3 - Ext FRP x ALF SGL - Card Access
100.12A	17 - Corr, Stair - Card Access
100.13	18 - Corr / Corr - Card Access
100. 14	30 - Existing to Remain
100.15	30 - Existing to Remain
100.16	3 - Ext FRP x ALF SGL - Card Access
100. 17	3B - Ext FRP x ALF - Card Access
100.18	20 - Exist Opening - New Core
100.19	20 - Exist Opening - New Core
100.20	20 - Exist Opening - New Core
100.21	29 - Exist Dr x Exist Frame - New Card Access
100.22	26 - Toilet Corr - Mag Holder
101	33 - Music, MDF, IDF - New Door & Exist Frame - Wireless Locks
102. 1	24 - Scene Shop WD x New FR - Card Access
102.2	3A - Ext FRP x ALF - Card Access
103.1	23 - Exist Opening - New Core
103.2	22 - Training Room - Card Access
104A	20 - Exist Opening - New Core
105	31 - Exist Door & Frame - New Wireless Locks
105A	6 - Office
106	31 - Exist Door & Frame - New Wireless Locks
106. 1	31 - Exist Door & Frame - New Wireless Locks
106A	6 - Office
106B	6 - Office
1O6C	6 - Office
106D	6 - Office
106E	6 - Office
106F	6 - Office
106G	6 - Office
107	19 - Shared Kitchen
108	1 - Ext FRP x New ALF - Card Access - Remote Release - Auto Operator
108.1	2 - Lobby - Exist Opng
108A	51 – New Core
109	9 - Elev Passage - HMD x HMF
1O9A	10 - Toilet - WD x HMF
109B	33 - Music, MDF, IDF - New Door & Exist Frame - Wireless Locks
1O9C	12 - Elec
109D	20 - Exist Opening - New Core
110	31 - Exist Door & Frame - New Wireless Locks

110A	8 - Conference
110B	6 - Office
110C	6 - Office
110D	6 - Office
111	31 - Exist Door & Frame - New Wireless Locks
113	31 - Exist Door & Frame - New Wireless Locks
115	20 - Exist Opening - New Core
115A	20 - Exist Opening - New Core
116	32 - IDF - New Door & Exist Frame - Wireless Locks
117	20 - Exist Opening - New Core
118	20 - Exist Opening - New Core
119	20 - Exist Opening - New Core
120	20 - Exist Opening - New Core
121	20 - Exist Opening - New Core
122	28 - Exist Dr x Exist Frame - New Card Access
123	20 - Exist Opening - New Core
124	28 - Exist Dr x Exist Frame - New Card Access
125	5 - Ext FRP x Exist FR - Card Access
200	20 - Exist Opening - New Core
200.1	37 - Stair - Card Access - El Trim Fail Safe
200.2	18 - Corr / Corr - Card Access
200.3	40 - Stair - Card Access Fail Safe -Exist Opng
200.4	40 - Stair - Card Access Fail Safe -Exist Opng
200.6	38 - Stair - Card Access - El Trim Fail Safe
201A	20 - Exist Opening - New Core
201B	20 - Exist Opening - New Core
202	20 - Exist Opening - New Core
203	20 - Exist Opening - New Core
203.1	20 - Exist Opening - New Core
205	20 - Exist Opening - New Core
206	23 - Exist Opening - New Core
2O6A	47 - Office
206B	6 - Office
207	23 - Exist Opening - New Core
207A	6 - Office
207B	20 - Exist Opening - New Core
2O7C	20 - Exist Opening - New Core
208	23 - Exist Opening - New Core
208A	47 - Office
208B	6 - Office
209	23 - Exist Opening - New Core
209A	34 - Mail/Copy
210	23 - Exist Opening - New Core
210A	6 - Office
210B	6 - Office
211	23 - Exist Opening - New Core
211.1	20 - Exist Opening - New Core

211A	6 - Office
212	23 - Exist Opening - New Core
212A	6 - Office
212B	6 - Office
213	23 - Exist Opening - New Core
213A	6 - Office
213B	20 - Exist Opening - New Core
214	23 - Exist Opening - New Core
214.1	20 - Exist Opening - New Core
214A	6 - Office
215	9 - Elev Passage - HMD x HMF
215A	11 - Phone Booth - WD x HMF
215B	48 - IDF - Card Access
215C	13 - Toilet
215D	14 - Elec
216	23 - Exist Opening - New Core
217	35 - Conf - WD x Exist Frame
219	36 - Future Finance
300	20 - Exist Opening - New Core
300A	20 - Exist Opening - New Core
300B	39 - Jan, Storage - Exist Opng
300.1	40 - Stair - Card Access Fail Safe -Exist Opng
300.2	40 - Stair - Card Access Fail Safe -Exist Opng
301	23 - Exist Opening - New Core
301.1	23 - Exist Opening - New Core
301A	6 - Office
3O1B	6 - Office
301C	8 - Conference
302	23 - Exist Opening - New Core
302.1	23 - Exist Opening - New Core
302A	49 - Office
302B	49 - Office
303	9 - Elev Passage - HMD x HMF
303A	50 - IDF - Card Access - New WD x HMF
303B	15 - Cafe
3O3C	16 - Elec
304	23 - Exist Opening - New Core
305	23 - Exist Opening - New Core
305A	6 - Office
305B	6 - Office
305C	6 - Office
305D	7 - Office, Mail/Print/Fax
306	23 - Exist Opening - New Core
306.1	23 - Exist Opening - New Core
306.2	23 - Exist Opening - New Core
306A	6 - Office
3O6B	6 - Office

306C	6 - Office
306D	6 - Office
307	20 - Exist Opening - New Core
308	39 - Jan, Storage - Exist Opng
105B	6 - Office
105C	6 - Office
104	20 - Exist Opening - New Core
B05.1	20 - Exist Opening - New Core
105D	6 - Office
302C	6 - Office
306E	6 - Office
306F	6 - Office

SECTION 08 71 13 – AUTOMATIC DOOR OPERATORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the following types of automatic door operators:
   1. Low-energy door operators for swinging doors.

B. Related Sections:
   1. Division 7 Sections for caulking to the extent not specified in this section.
   2. Division 8 Sections for “Aluminum-Framed Entrances and Storefronts” for entrances furnished and installed separately in Division 8 Section.
   3. Division 8 Section “Door Hardware” for hardware to the extent not specified in this section.
   4. Division 8 Section “Glazing” for materials and installation requirements of glazing for automatic entrances.
   5. Division 26 and 28 Sections for electrical connections including conduit and wiring for automatic entrance operators and access-control devices.

1.3 REFERENCES

A. References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. CUL – Approved for use in Canada.
   4. NFPA 70 - National Electrical Code.
   5. NFPA 80 - Fire Doors and Windows.
   6. NFPA 101 - Life Safety Code.
   7. NFPA 105 - Installation of Smoke Door Assemblies.

B. American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA).
   1. ANSI/BHMA A156.19 Standards for Power Assist and Low Energy Power Operated Doors.

C. Underwriters Laboratories (UL).
   1. UL10C – Positive Pressure Fire Tests of Door Assemblies.
   2. UL 325 - Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.

D. American Association of Automatic Door Manufacturers (AAADM).

E. American Society for Testing and Materials (ASTM).
   1. ASTM B221 Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
   2. ASTM B209 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.

F. American Architectural Manufacturers Association (AAMA).
1. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.

G. National Association of Architectural Metal Manufacturers (NAAMM).
1. Metal Finishes Manual for Architectural Metal Products.

H. International Code Council (IBC).
1. IBC: International Building Code Building Code.

1.4 DEFINITIONS

A. Activation device: Device that, when actuated, sends an electrical signal to the door operator to initiate the door operation.

B. Monitored Safety Devices: A tested system that works in conjunction with the automatic door control that detects the presence of a person or an object within a zone where contact could occur and provides a signal to stop the movement of the door.

C. AAADM: American Association of Automatic Door Manufacturers.

D. Operating ambient Temperature Range: 5 Degrees F to plus 122 degrees F (minus 15 C to 50 degrees C).

E. For automatic door terminology, refer to ANSI/BHMA A 156.19 for definitions of terms.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide automatic doors that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturers corresponding systems.

B. Compliance:
1. ICC/IBC International Building Code
2. ANSI/BHMA A 156.19 American National Standard for Power Operated Doors Pedestrian Doors.
3. UL 325 Listed
4. NFPA 70 National Electrical Code.
5. NFPA 101 Life Safety Code
6. CUL Approved for use in Canada
7. UL Listed Fire Door Operator with Automatic Closer

C. Automatic Door equipment accommodates medium to heavy pedestrian traffic.

D. Opening Force Requirements:
1. Power-Operated swinging doors shall open with a manual force not to exceed 30 lbf (133N) to set the door in motion and 15 lbf to fully open the door with force applied at 1” (25mm) from the latched edge of the door. The required force to prevent a stopped door from opening or closing shall to exceed 15 lbf (67N) measured 1” (25mm) from the latch edge of the door at any point during the opening or closing.

E. Closing Time:

1. Door operators shall be field adjustable to close 90 degrees to 10 degrees in 3 seconds or longer per ANSI/BHMA A 156.19 standard.
2. Door shall be field adjusted to close from 10 degrees to fully closed position in not less than 1.5 seconds.

1.6 SUBMITTALS

A. Comply with Division 01 – Submittal Procedures.

B. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles fabrication, operational descriptions and finishes.

C. Shop Drawings: For automatic entrances. Include plans, elevations, sections, details, hardware mounting heights, additional accessories and attachments to other work.

D. Samples: color samples of exposed finish as required.

E. Informational Submittals: Manufacturers product information and applicable sustainability program credits that are available towards a LEED rated product certification.
1. Credit MR 4.1 and 4.2: Manufacture's or fabricator's certificate indicating percentage of post-consumer recycled content by weight and pre-consumer recycled content by weight for each product specified under this section.

F. Manufacturers Field Reports: Submit manufacturer's field reports from AAADM certified technician of inspection and approval of doors for compliance with ANSI/BHMA A 156.19 after completion of installation.

G. Operating and Maintenance Manuals: Provide manufacturers operating, owners and maintenance manuals for each item specified as required in Division 01, Closeout Submittals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: 10 years minimum of documented experience in manufacturing door equipment similar to that indicated within this specification with a proven record of successful service performance. A manufacturer with company certificate issued by AAADM.

B. Installer Qualifications: Installers with a minimum 5 years documented experience installing and maintenance of units similar in material, design, and extent to that indicated in this specification and whose work has resulted in construction with a record of successful in-service performance.

C. Source Limitations for Automatic Operators: Obtain each type of automatic door operator and senor components specified in this section from single source from single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Power-Operated Door Standard: ANSI/BHMA A 156.19 Current year.

F. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings to receive automatic entrances by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate door operators with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of project.

B. Electrical System Roughing-in: Coordinate layout and installation of automatic power door operator with connections to power supplies and access-control system.

1.10 WARRANTY

A. Automatic Door Operators to be free of defects in material and workmanship for a period of One (1) year from the date of substantial completion.

B. During the warranty period a factory trained technician shall preform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form submitted to the owner.

C. During the warranty period all warranty work shall be performed during normal working hours.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. dormakaba • Reamstown, PA • 1-844-SPEC-NOW (1-844-773-2669) • Website: www.dormakaba.us • Email: specnow@dorma.com, or approved equal

B. **Substitutions: Requests for substitution and product approval in compliance with the specification must be submitted in writing and in accordance with the procedures outlined in Division 1, Section "Substitution Procedures". Approval of requests is at the discretion of the architect, owner, and their designated consultants.**

2.2 AUTOMATIC SWING DOOR OPERATOR

Door 108: 1ea Auto Operator Exterior Card Reader x Actuator Both Sides.

A. Model: DORMA, ED Series **ED250** (Basis of Design) An Integrated, self-learning automatic swing door operator with an advanced CPU, a multistage gearbox with real time adaptive software and available user interface.
   1. Automatic Door Configuration:
      a. Configuration: Single swing door or pair of doors swinging.
      b. Traffic Pattern: **two-way as shown on drawings**
      c. Mounting: Surface applied

B. Approved substitution manufacturer.

1. Stanley Access Technologies; M-Force Operator with Swing Guard Safety system.
2. Besum Entrance Solutions; an ASSA ABLOY Group Company

C. Control Features
1. Power-hold Close
2. Built in Lock Delay
3. On-Off-Hold Open switch control to control door function, (Automatic-Hold Open- Exit Only)
4. On-Off Power Switch
5. Fire Alarm Integration
6. Field Adjustable Handing
7. **Push and Go**
8. **Power Assist Opening Activation**
9. Intergraded Connections for Monitored Safety Sensors and other accessories.
10. Integrated access control

D. Door Control Features
1. Wind Load and Stack Pressure microprocessor monitored with power boost to ensure secure opening and closing in changing conditions.
2. Door Weight Max. **ED 250 800 lbs.**

E. Header Size: Narrow header at 4” height by 6” depth

2.3 ACTIVATION DEVICES

A. Activation Device:
1. **RCI 946HP475- MO Push Plate: Hard wired engraved with "Push to Open" with a handicap logo.**
2. **Access control activator: Card readers As shown at locations on drawings.**

2.4 ELECTRICAL

A. Electrical 115 V AC +/- 10% 50/60 Hz 6.6 A max.

2.5 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Anodized Finish:
1. **Color Anodic Finish: AAMA 611, AA-M12C22A44, Class I, 0.018 mm**

EXECUTION

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames with Installer present, for compliance with requirements for installation tolerances, wall and floor construction and other conditions affecting performance of automatic entrances.

B. Examine roughing in for electrical source power to verify actual locations of wiring connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.

C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections

D. Sealants: Comply with requirements specified in Division 07 Section "Joint Sealants" to provide seal between the operator housing and wall surface. installation.

E. Signage: Apply signage on both sides of each door and each sidelight as required by ANSI/BHMA A 156.19

3.3 FIELD QUALITY CONTROL

A. Manufacturer’s representative shall provide technical assistance and guidance for installation of automatic doors.
1. Factory trained and AAADM certified representative shall test and inspect each automatic door to determine compliance of the installed system to ANSI/BHMA A 156.19

3.4 ADJUSTING

A. Adjust door operators and controls for smooth and safe operation.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by automatic operator installation promptly after installation .

3.6 DEMONSTRATION

A. Engage a factory authorized representative to train Owner's maintenance personnel to adjust, operate, and maintain safe operation of automatic entrances.

END OF SECTION 087113

SECTION 088000

GLASS AND GLAZING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the glass and glazing as shown on the drawings and/or specified herein, including but not limited to glazing of the following:

1. Doors.
2. Entrances.
3. Storefront framing.
4. Interior borrowed lites.
5. Interior mirrors, frameless.

1.3 RELATED SECTIONS

A. Hollow metal doors and frames - Section 081113.

B. Aluminum entrances and storefronts - Section 084113.

C. Framed mirrors - Section 102800.

1.4 REFERENCES

A. Comply with the recommendations of the following references unless more stringent requirements are indicated herein.

1. FGMA Publications: FGMA Glazing Manual.
2. AAMA Publications: AAMA TIR-A7 Sloped Glazing Guidelines and Glass Design for Sloped Glazing.
3. LSGA Publications: LSGA Design Guide.
4. SIGMA Publications: TM-3000 Vertical Glazing Guidelines and TB-3001 Sloped Glazing Guidelines.
5. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201.

6. Fire-Resistive Glazing Products for Door Assemblies: Products identical to those tested per ASTM E l52, labeled and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

7. Fire-Resistive Glazing Products for Window Assemblies: Products identical to those tested per ASTM E 163, labeled and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

8. 16 CFR 1201, Safety Standards for Architectural Glazing, Sealed Insulating Glass Manufacturing Association.

9. ASTM C 920, Elastomeric Joint Sealant.

10. SAFETY ANSI Z97.1.

11. Insulating Glass Criteria - IGCC International Glass Cert. Council.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thicknesses indicated on drawings and/or specified herein are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

   a. Specified Design Wind Loads: 30 psf or greater if required by Code.

2. Probability of Breakage for Vertical Glazing:

   a. 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
   b. 1 lite per 1000 for lites installed 15 degrees from the vertical land and under wind action.
   c. Load Duration: 60 seconds or less.

3. Maximum Lateral Deflection: For glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/100 times the short side length or 0.5", whichever is less.

4. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

a. Temperature Change (Range): 120 deg. F ambient; 180 deg F, material surfaces.

5. Thermal Solar Performance: See Article 2.2 herein.

C. Glass units shall be annealed, heat strengthened, fully tempered or laminated where required to meet wind and/or snow loads and safety glazing requirements, as shown, specified or recommended by the glass fabricator and as required by the prevailing Building Code.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, specifications, standard details, glazing instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements, including performance requirements.

B. Submit compatibility and adhesion test reports from sealant manufacturer indicating materials were tested for compatibility and adhesion with glazing sealant, as well as other glazing materials including insulation units.

C. Initial Selection Samples: Submit samples of each glass and glazing material showing complete range of colors, textures, and finishes available for each material used.

1. Submit complete range of samples of standard colors and patterns for ceramic frits at insulating glass.

2. Submit complete range of samples of sandblasted glass showing variations of grits and opacity achieved.

D. Verification Samples: Submit representative samples of each glass and glazing material that is to be exposed in completed work. Show full color ranges and finish variations expected. Provide glass samples having minimum size of 144 sq. in. and 6 in. long samples of sealants and glazing materials; all samples shall bear the name of the manufacturer, brand name, thickness, and quality.

E. Calculations: Provide wind load charts, calculations, thermal stress analysis, and certification of performance of this work. Indicate how design requirements for loading and other performance criteria have been satisfied. Document shall be signed and sealed by a Professional Engineer licensed in the State of New Jersey.

F. Test Reports: Provide certified reports for specified tests.

G. Warranties: Provide written warranties as specified herein.

1.7 QUALITY ASSURANCE

A. Source: For each glass and glazing type required for work of this Section, provide primary materials which are products of one manufacturer. Provide secondary or accessory materials which are acceptable to manufacturers of primary materials.

B. Installer: A firm with a minimum of five years experience in type of work required by this Section and which is acceptable to manufacturers of primary materials; and with a successful record of in-service installations similar in size and scope to this Project.

C. Glass Thickness: Glass thicknesses shown on drawings and/or specified herein are minimum thicknesses. Determine and provide size and thickness of glass products that are certified to meet or exceed performance requirements specified in this Section.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated.

1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."

2. IGMA Publications: IGMA TM-3000, "Vertical Glazing Guidelines for Sealed Insulating Glass Units."

E. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council.

2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

F. Insulating Glass Certification Program: Permanently marked on spacers with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.

2. Associated Laboratories, Inc.

3. Insulating Glass Manufacturers Alliance.

G. Manufacturer shall be ISO 9001-2000 Certified.

H. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies

1.8 TESTS

A. Preconstruction Sealant Test: Submit samples of materials to be used to glazing sealant manufacturer to determine sealant compatibility. Include samples of glass, gaskets, glazing materials, framing members, and other components and accessories of glazing work. Test in accordance with ASTM C 794 to verify what type of primers (if any) are required to ensure sealant adhesion to substrates.

1. Submit minimum of nine pieces of each type and finish of framing member, and nine pieces of each type, class, kind, condition, and form of glass, including monolithic, laminated, and insulating glass for adhesion tests.

2. Provide manufacturer's written report and recommendations regarding proper installation.

1.9 PROJECT CONDITIONS

A. Weather: Perform work of this Section only when existing or forecasted weather conditions are within limits established by manufacturers of materials and products used.

B. Temperature Limits: Install sealants only when temperatures are within limits recommended by sealant manufacturer, except, never install sealants when temperatures are below 40 deg. F.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations and GANA Manual.

1. Protect materials from moisture, sunlight, excess heat, sparks and flame.

2. Sequence deliveries to avoid delays, but minimize on-site storage.

1.11 WARRANTIES

A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

B. Manufacturer's Special Project Warranty on Coated Glass Products: Provide written warranty signed by manufacturer of coated glass agreeing to furnish f.o.b. point of manufacture, within specified warranty period indicated below, replacements for those coated glass units which develop manufacturing defects. Manufacturing defects are defined as peeling, cracking or deterioration in metallic coating due to normal conditions and not due to handling or installation or cleaning practices contrary to glass manufacturer's published instructions.

1. Warranty Period: Manufacturer's standard but not less than five (5) years after date of substantial completion.

C. Manufacturer's Special Project Warranty on Insulating Glass: Provide written warranty signed by manufacturer of insulating glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within specified warranty period indicated below, replacements for those insulating glass units developing manufacturing defects. Manufacturing defects are defined as failure of the hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coatings, if any, and other visual indications of seal failure or performance; provided the manufacturer's instructions for handling, installing, protecting and maintaining units have been complied with during the warranty period.

1. Warranty Period: Manufacturer's standard but not less than ten (10) years after date of substantial completion.

D. Manufacturer’s Special Project Warranty on Laminated Glass: Manufacturer’s standard form, made out to Owner and signed by laminated glass manufacturer agreeing to replace laminated glass units that deteriorate as defined in “Definitions” Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty period five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/FABRICATORS

A. All glass and glazing used at the exterior of the Project shall be manufactured by the same manufacturer. The same manufacturer and the same furnace shall be used for all tempered and heat strengthened glass used throughout the project. Acceptable manufacturers include the following:

1. Vitro Architectural Glass

2. Guardian Industries.

3. Pilkington.

4. AFG.

5. Viracon.

2.2 GLASS MATERIALS AND PRODUCTS

A. Clear Float Glass: ASTM C 1036, Type I (Transparent, Flat), Class 1 (Clear), Quality q3, minimum 1/4" thick.

B. Clear Tempered Glass: ASTM C 1048, Condition A (Uncoated), Type I (Transparent, Flat), Class 1 (Clear), Quality q3, Kind FT, minimum 1/4" thick. Tempered glass must be certified by SGCC to meet applicable standards. Tempered glass shall also conform to the following:

1. Length and Width: For 2.9 mm to 6.0 mm; +/-1.6 mm.

2. Diagonal: +/- 3.0 mm.

3. Edgework: Belt seaming or diamond wheels. 1.5 mm seam of upper and lower glass edges. No sharp edges.

4. Corners: No more than 3.0 mm from square.

5. Float Glass Defects: Must meet the requirements of ASTM C 1036. The most common defects are scratches, stones gaseous bubbles and edge chips. Tables in the glass standards have limits for size/quantity of defects.

6. Tempered glass shall have a minimum surface compression of 10,000 psi.

7. Tempered glass to be heat-treated by horizontal (roller hearth) process with inherent roller-wave distortion parallel to the bottom edge of the glass when installed.

8. Flatness Tolerances

   a. Roller-Wave or Ripple: The deviation from flatness at any peak shall be targeted not exceed 0.003” as measured per peak to valley for 1/4” (6mm) thick glass.
   b. Bow and Warp: The bow and warp tolerances shall not exceed 1/32” per linear foot.
   c. Fully tempered glass shall be heat soaked to EN 14179-1:2005-European Heat Soaking Standard.

C. Low 'E' Coated Glass: Provide high-performance, clear, metallic coating, equal to ___, as manufactured by __. Provide Low 'E' coating which has the following performance characteristics when applied to the No. 2 surface of 1" insulating units, both lites 1/4" clear:

1. Visible Transmittance: ___%

2. Visible Reflectance ___%

3. Winter U-value ___

4. Shading Coefficient SC: ___

5. Solar Heat Gain Coefficient (SHGC) ___

D. Laminated Safety Glass: Provide two glass panes of equal thickness, laminated together with a polyvinyl butyl interlayer, conform to ASTM C 1172, and as follows:

1. Interlayer Color: Clear.

2. Interlayer Material: Provide Sentry Glass Plus by Dupont, Kuraray America, 0.030" thick at vertical applications, and 0.060" thick at sloped or horizontal applications.

3. Minimum thickness of 1/4".

E. Insulating Glass: Insulated glass composition shall consist of 1/4" clear exterior lite of float (or tempered, where required) glass with Low E coating on No. 2 face, 1/2" air space and 1/4" clear interior lite of float (or tempered, where required) glass. Provide factory assembled units of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space, complying with ASTM E 2190, and as follows:

1. Sealing System: Dual Seal.

2. Primary Sealant: Polyisobutylene.

3. Secondary Sealant: Silicone, General Electric IGS 3204 or IGS 3100, or Dow Corning 982.

a. For structurally glazed IG units, secondary seal shall conform to ASTM C 1249.

4. Primary and secondary seals shall not contain voids and must be continuously bonded to the glass structure.

5. Spacer: Clear finish aluminum with welded, soldered, or bent corners, hollow tube types, filled with low nitrogen absorption desicant.

6. Desiccant: Molecular sieve, silica gel, or blend of both.

7. Air Space Thickness: 1/2".

8. Glass Thickness: 1/4" minimum.

9. Units shall be certified for compliance with seal classification "CBA" by the Insulating Glass Certification Council (IGCC) or by IGMA, and tested in accordance with the above ASTM Test Methods.

10. Insulating glass shall conform to the following tolerances:

    a. Length and Width: + 3.0 mm/ -2.0 mm.
    b. Diagonal: +/- 3.0 mm.
    c. Thickness: As agreed +/- 1.0 mm.
    d. Edge-Deletion of Coating: Minimum 8 mm wide. Width of deletion must be more than the width of the secondary seal. Silver layer(s) must be completely removed. Appearance must be uniform.
    e. Primary PIB Seal: Must be complete with no breaks. Appearance must be uniform. PIB bead must overlap coating. No visible bright line when glass is viewed in transmission. The width of the PIB bead shall be 4.0 mm + 3.0/ - 1.5 mm.
    f. Secondary Seal: Nominal 6 mm + 3.0/ - 1.5 mm. The minimum width of the secondary silicone seal for IG units that are glazed structurally must be determined according to ASTM C 1249. The secondary seal must be uniformly applied without bubbles, cavities or gaps. Avoid excess sealant that will need to be trimmed off later.

11. Additional requirements and properties for primary and secondary insulating glass seals and spacers:

    a. All glass units shall comply with IGMA Guidelines which limits the dimension of the visible edge seal encroachment into the vision area to be no greater than the “sightline infringement of 3mm (0.12”).
    b. Insulating glass unit hermetic seal to consist of butyl primary and silicone secondary seals with bent, welded, or soldered interpane spacer corners; keyed corners are not acceptable unless also soldered or welded. Spacers shall be aluminum or stainless steel. Locate spacer joint at the top or sides of the units, but in no instances at the sill. Design units to minimize the number of spacer joints. Provide solid keys, embedded in butyl sealant on all four sides, at spacer joints.
    c. Hermetic seals must be continuous and intimately bonded to both lites of glass. Provide primary seal of uniform depth with a nominal width of 1/8 to 3/16 in. Hermetic seals shall not be contaminated with debris, fingerprints, or

other foreign matter and shall not contain voids or air pockets that decrease the width of the seal below the minimum widths listed in these Specifications, or that breach the seal. The width of the primary seal shall not be less than 1/16 in., and the total cumulative length of the primary seal between 1/16 in. and 1/8 in. shall be less than 12 in. in any one insulating glass unit. The primary seal shall not have a reduced thickness at the corners. An increased thickness of the primary seal at the corners is acceptable.

d. Provide secondary seal of uniform depth with a nominal width of 1/4 in. Provide a total width of the primary and secondary seal of 1/2 in. Units shall meet SIGMA 65-7-2, latest edition. Units shall not contain breather or capillary tubes or similar penetrations.

F. Frameless Mirrors: 1/4", Quality q2, clear float glass with silver, copper, and organic coating, and as follows:

1. Edges: Uniformly ground and polished.

2.3 GLAZING MATERIALS AND PRODUCTS

A. General: Provide sealants and gaskets with performance characteristics suitable for applications indicated. Ensure compatibility of glazing sealants with insulating glass sealants, with laminated glass interlayers, and with any other surfaces in contact.

B. General Glazing and Cap Bead Sealant: Provide sealant with maximum Shore A hardness of 50. Provide one of the following:

1. Dow Corning 795.

2. General Electric Silglaze N 2500 or Contractors SCS-1000.

3. Tremco Spectrem 2.

C. Weather Seal Sealant: Provide non-acid curing sealant with movement range $\pm$ 50%, ASTM C 719. Provide one of the following:

1. Dow Corning 795.

2. General Electric Silpruf.

3. Tremco Spectrem 2.

D. Backer Rod: Closed cell non-gassing polyethylene rod with rod diameter 25% wider than joint width.

E. Dense Elastomeric Compression Seal Gaskets: Provide molded or extruded neoprene or EPDM gaskets, Shore A hardness of 75$\pm$5 for hollow profile, and 60$\pm$5 for solid profiles, ASTM C 864.

F. Cellular, Elastomeric Preformed Gaskets: Provide extruded or molded closed cell, integral-skinned neoprene, Shore A 40$\pm$5, and 20% to 35% compression, ASTM C 509; Type II.

G. Preformed Glazing Tape: Provide solvent-free butyl-polyisobutylene rubber with 100% solids content complying with ASTM C1281 AAMA A 800 with integral continuous

EPDM shim. Provide preformed glazing tape in extruded tape form. Provide Tremco "Polyshim II" or approved equal.

H. Setting Blocks: Provide 100% or silicone blocks with Shore A hardness of 80-90. Provide products certified by manufacturer to be compatible with silicone sealants. Length to be not less than 4". Width for setting blocks to be 1/16" more than glass thickness and high enough to provide the lite recommended by glass manufacturer. When thickness of setting block exceeds 3/4" the glass manufacturer must be consulted for sizes and configuration. In a vented system, setting block shall be designed so as to not restrict the flow of water within the glazing rabbet to the weep holes.

1. Shims: For shims used with setting blocks, provide same materials, hardness, length and width as setting blocks.

2. Structural Silicone Glazing: Provide silicone setting blocks where structural silicone occurs at sills and at insulating units with silicone edge seals.

I. Edge Blocks: Provide neoprene or silicone as required for compatibility with glazing sealants. Provide blocks with Shore A hardness of 55±5.

J. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place.

K. Miscellaneous Glazing Materials: Provide sealant backer rods, primers, cleaners, and sealers of type recommended by glass and sealant manufacturers.

L. Mirror Adhesive: Palmer's "Mirro-Mastic", or approved equal; mastic must be compatible with mirror backing.

1. Clips: No. 4 finish Type 304 stainless steel.

2.4 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

C. Grind smooth and polish exposed glass edges.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Presence and functioning of weep system.

3. Minimum required face or edge clearances.

4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GENERAL GLAZING STANDARDS

A. Install products using the recommendations from the manufacturer of glass, sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those in the “GANA Glazing Manual”.

B. Verify that Insulating Glass (IG) Unit secondary seal is compatible with glazing sealants.

C. Install glass in prepared glazing channels and other framing members.

D. Install setting blocks in rabbets as recommended by referenced glazing standards in GANA Glazing Manual” and “IGMA Glazing Guidelines”.

E. Provide bite on glass, minimum edge and face clearances and glazing material tolerances recommended by “GANA Glazing Manual”.

F. Provide weep system as recommended by “GANA Glazing Manual”.

G. Set glass lites in each series with uniform pattern, draw, bow and similar characteristics.

H. Distribute the weight of glass unit along the edge rather than the corner.

I. Comply with manufacturers and referenced industry standards on expansion joint and anchors; accommodating thermal movement; glass openings; use of setting blocks, edge, face, and bite clearances; use of glass spacers; edge blocks and installation of weep systems.

J. Protect glass edge damage during handling and installation.

K. Prevent glass from contact with contaminating substances that result from construction operations, such as weld spatter, fireproofing or plaster.

L. Remove and replace glass that is broken, chipped cracked or damaged in any way.

3.4 GLAZING

A. Glazing channel dimensions, as indicated on Shop Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair

performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead. Install setting blocks at the one greater points of each lite along the horizontal mullion.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

K. Flush Glazing

1. If the butt joint in the metal framing is in the vertical direction, the glazier shall run the tape initially on the head and sill members going directly over this joint. Should the butt joint in the metal framing run horizontally, tapes must first be applied to the jambs so that it crosses over the joint.

2. Each tape section shall butt the adjoining tape and be united with a tool to eliminate any opening.

3. Do not overlap the adjoining length of tape or rubber shim as this will prevent full contact around the perimeter of glass.

L. Off-Set Glazing

1. Where the glazing legs are off-set, the difference in the rabbet width shall be compensated by employing different glazing tapes with different diameter shims. The difference in shim shall be equal to the size of the off-set. The thinner tape shall be positioned first on the glazing leg closest to the interior. The thicker tape shall be cut to the exact length of the dimension between the applied tapes, and installed on the outermost glazing leg.

2. Immediately prior to setting glass, paper backing shall be removed. Apply a toe bead of sealant 6" in each direction, from each corner.

3. Locate setting blocks in the sill member at quarter points, or if necessary to within 6" of each corner. Setting blocks must be set equal distance from center line of the glass and high enough to provide the recommended bite and edge clearances.

4. Set edge block according to glass manufacturer's recommendations.

5. Set Glass: The glass shall be pressed firmly against the tape to achieve full contact.

6. In a vented system, apply a heel bead (air seal) of sealant around the perimeter of glass, between the sole of the I.G. unit and the base of the rabbet of the metal framing developing a positive bond to the unit and to the metal framing. The bead of the sealant shall be deep enough so that it will partially fill the channel to a depth of 1/4" between the glass edge and the base of the metal framing rabbet.

7. Interior stops shall be set, and glazing tape spline for the appropriate face clearance shall be rolled into place, compressing the glass to the shim within the glazing tape.

3.5 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant as recommended by glass manufacturer or glass frame manufacturer.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces

of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape where noted on approved shop drawings.

3.6 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.7 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

1. Exterior glazing gasket shall be set a minimum of 1/8” below exterior glazing stop to create a channel for sealant installation.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.8 FRAMELESS MIRRORS

A. Apply mastic to back of mirror "pats" spaced 4 pats/sq. ft.; adjust mirror so that it is plumb and in place to avoid distortion of reflecting images. Allow 1/8" space between back of mirror and wall surface.

1. Apply "pats" using Palmer Electric Applicator.

B. Apply stainless steel clips at mirror top and bottom; securely clip to substrate using non-corrosive anchors. At drywall back-up anchors must be secured to studs or steel wallplate spanning from stud to stud.

3.9 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Clean excess sealant or compound from glass and framing members immediately after application, using solvents or cleaners recommended by manufacturers.

F. Glass to be cleaned according to:

1. GANA Glass Informational Bulletin GANA 01-0300 – “Proper Procedure for Cleaning Architectural Glass Products”.

2. GANA Glass Informational Bulletin GANA TD-02-0402 – “Heat Treated Glass Surfaces are Different”.

G. Do not use razor blades, scrapers or metal tools to clean glass.

END OF SECTION

SECTION 090120

MAINTENANCE OF PLASTER

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the plaster patching work for existing plaster surfaces scheduled to remain and as specified herein, including, but not limited to, the following:

1. Contractor shall survey all areas where existing plaster is shown to remain, in order to verify extent of patch or repair. Scope of work to include plaster patching at all areas scheduled to receive new paint, plaster skim coat or wall covering.

2. Cutting out and removing existing interior plaster surfaces where needed to repair existing gypsum plaster.

3. Cutting out and removing existing plaster on walls and ceilings as required for installation of new work.

4. Repair and patching cracks, spalls, delaminations, breaks, losses, chips, holes or other defects in gypsum plaster surfaces.

5. Repair of existing ornamental plaster designs and moldings, including making molds of existing designs for replication elsewhere as indicated.

6. Providing plaster accessories and associated Work.

7. Providing new plaster to align with existing plaster at existing walls and ceilings.

8. Application of skim coat of plaster over new and existing plaster ceilings and walls to remain.

1.3 RELATED SECTIONS

A. Interior Painting - Section 099000

1.4 QUALITY ASSURANCE

A. Conform to the following standards:

1. ASTM C 841 - Standard Specification For Installation of Interior Lathing And Furring.

2. ASTM C 842 - Standard Specification For Application of Interior Gypsum Plaster.

3. ASTM C 847 - Standard Specification For Metal Lath.

4. ASTM C 28 - Standard Specification For Gypsum Plasters.

5. ASTM C 631-81 - Standard Specification For Bonding Compounds For Interior Plastering.

6. ASTM C 35 - Standard Specification For Inorganic Aggregates For Use In Gypsum Plaster.

7. ASTM C 206 - Standard Specification For Finishing Hydrated Lime.

B. Allowable Tolerances: All plaster repairs shall be keyed and feathered to exactly match and continue edges and contours of existing plaster work. Repairs shall be true and flat in connections with adjacent surfaces when checked with an 8 ft. straight edge; do not exceed 1/8-inch variation in 8 ft. for bow, warp, plumb, or level for flat and curved surfaces.

C. Defects

1. Plastering with defects of such character as will mar the appearance of finished Work, or which is otherwise defective, shall be rejected, removed and replaced at the Contractor's expense.

2. All ridges, ledges and visual irregularities shall be rejected, removed, and plaster replaced at the Contractor's expense.

3. Any defects or irregularities of plaster restoration work telegraphing through paint shall be cause for rejection of the Work. The Contractor shall remove any subsequent work, remove and replace the defective or irregular plaster restoration work and have the subsequent work replaced by skilled workman in the appropriate trades, to the satisfaction of the Architect, at the Contractor's expense.

1.5 SUBMITTALS

A. Materials List: Before any materials are delivered to the job site, submit a complete list of all the materials proposed to be furnished and installed.

B. Product Data: Submit manufacturer's product data for plaster materials, lath, metal support components, and accessories; including manufacturer's current recommendations as to methods and installation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer.

B. Store materials inside, under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes. Neatly stack gypsum lath flat to prevent deformation.

C. Handle gypsum lath to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

1.7 PROJECT CONDITIONS

A. Environmental Requirements, General: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after application of plaster.

B. Ventilation: Ventilate building spaces in compliance with ASTM C 842 and as required to remove water in excess of that required for hydration of plaster. Begin ventilation immediately after plaster is applied and continue until it sets.

C. Protection: Restoration of existing plaster shall be done in such manner as not to cause damage to contiguous work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Gypsum Plaster System: Provide gypsum plaster with vermiculite aggregate as manufactured by United States Gypsum Company, or approved equal.

B. Materials

1. Aggregate: Vermiculite, premixed with plaster.

2. Water: Clean, fresh, potable, and free from injurious amounts of oils, acids, alkalis and organic matter injurious to the plaster.

3. Gypsum plaster shall conform to the requirements of ASTM C 28, latest edition.

4. Prepared Finish Coat: Factory prepared finish for gypsum plaster, type recommended by the manufacturer for specified finish.

5. Bonding Agent: For bonding new plaster to existing plaster, provide "Plasterweld" as manufactured by Larsen products, or approved equal.

C. Metal Accessories: Grounds and casing corner beads shall be zinc-coated sheet steel, 26 ga. or heavier, with expanded or perforated flanges or clips so shaped and fabricated as to permit complete embedment in the plaster.

D. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet with ASTM A 653, G60, hot-dip galvanized-zinc coating.

1. Paper Backing: Kraft paper factory bonded to back of lath.

2. Diamond-Mesh Lath: Self-furring, No. 24 gauge, 3/8" diamond mesh expanded steel.

3. Lath Hangers: 6 SWG galvanized steel.

2.2 MIXING OF PLASTER

A. Mix and apply plaster in accordance with the directions of the manufacturer.

B. Texture of finishing coat shall match existing plaster.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where plaster work is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Architect.

3.2 GENERAL

A. Sequence plaster installation properly with the installation and protection of other work, so that neither will be damaged by the installation of other work.

B. Cut out and replace all unbonded spots. Build in the work in others and do all cutting and patching of plaster in this connection. Where abutting other built-in materials, plaster shall be finished tightly against them and neatly trimmed, unless otherwise indicated.

C. Plaster thicknesses indicated shall be considered as a minimum; plaster shall be of such thickness required to plumb and square wall surfaces so that plaster is flush with adjacent surfaces.

D. Replicate, repair and restore flat wall plaster as indicated.

E. Plaster repairs shall be executed edge to edge in long strips or large areas for each separate coat. Where breaks are necessary lap new work over adjoining work.

F. Bring finished surfaces of plaster to true planes. When complete surface shall be clean, free from blisters, pits, discoloration, cracks or other defects. In all cases the plastering throughout is to be delivered clean and perfect in every respect.

3.3 PREPARATION

A. Inspect all surfaces to be plastered before beginning Work and correct all defects which will affect the proper execution of this Work.

B. Carefully remove all soft, broken, loose or flaking plaster back to substrate and to solid adjacent plastering, making clean and sharp edges; cut back the existing plaster at an angle so that the patching will key properly and blend in with the existing surfaces at both sides of the crack. Where necessary, partially remove existing metal lath, leaving enough lath exposed to tie to new lath. Sweep masonry and lath clean and dampen immediately prior to replastering. Keys in masonry and metal lath substrates shall be cleaned of all existing plaster. Masonry substrates shall be prewetted to prevent excessive suction and too rapid drying. Join new work and make flush with contiguous work.

C. Cracks: Hairline cracks, random cracking and checking shall be repaired using plaster crack patching compound specified herein.

D. Bonding compound shall be applied to all plaster, concrete and masonry surfaces for all plaster repairs. Application shall be in strict accordance with manufacturer's written recommendations and first and brown coats shall be applied directly over bonding compound.

E. All preparation shall be done with compatible materials and methods that will not compromise the integrity of the plasters, and will not telegraph through finished surfaces.

3.4 PATCHING AND REPAIRING EXISTING PLASTER WITH NEW PLASTER

A. Preparation

1. Remove all soft, broken, loose, delaminated, non-adhering, or flaking plaster back to masonry or lath and to solid, sound adjacent plaster, making clean and sharp edges, beveled inward toward substrate to provide mechanical key. Ensure that remaining plaster is completely bonded to substrate. Remove deteriorated substrate. Brush and vacuum masonry and/or lath on which new plaster is to be applied clean and free of all existing plaster and other contaminants.

2. Provide new metal lath and supporting elements as required to provide secure, sound substrate.

3. Dampen masonry 24 hours prior to replastering, and dampen again immediately prior to replastering to prevent excessive suction and too rapid drying, unless specifically recommended otherwise by bonding agent manufacturer.

4. Install new metal lath in all locations where lath is missing and/or where substrate has been removed using stainless steel staples and tie wires. Attach metal lath to existing wood lath or existing sound masonry. Follow all manufacturer’s recommendations.

B. Bonding Agent: Apply bonding compound on plaster and masonry surfaces in strict accordance with manufacturer’s recommendations.

C. Gypsum Plaster on Metal Lath: Provide three-coat plaster (scratch, brown, and finish coats) having a total thickness not less than 5/8 inch. At fire rated conditions thickness as required to achieve rating.

1. Scratch Coats: Apply with sufficient material and pressure to form full bond with solid base materials. Scratch the surface to form a bond for the brown coat.

2. Brown Coats: Do not apply brown coat until after the scratch coat has hardened, and not less than 24 hours after application of the scratch coat. All joints in brown coat plaster shall be lap joints. After drying, all shrinkage cracks shall be cut out and filled with scratch coat plaster.

3. Mix scratch and brown coats shall be mixed in the proportions of 100 lbs. gypsum neat plaster to 2-1/2 cu. ft. of sand. Scratch and brown coats of fibered gypsum

plaster shall be mixed in the proportions of 100 lbs. fibered gypsum plaster to one cu. ft. of sand.

4. Finish Coats: Gypsum gauging plaster finish. Mix in the proportion of one part calcined gypsum, to 3 parts of lime putty by volume. Apply bonding compound to existing base coat and then apply finish coat over base coat of gypsum plaster. The finish shall be allowed to draw a few minutes and then shall be well troweled with water to a smooth finish, free from blemishes. The thickness of finish coat shall be from 1/16" to 1/8" and total thickness of gypsum plaster shall be as indicated but no less than 5/8".

D. Gypsum Plaster Finish Coat on Existing Base Coats: Apply bonding agent to existing base coat following manufacturer's directions and then apply finish coat as specified above.

3.5 PATCHING CRACKS IN PLASTER

A. General: Repair cracks as indicated on Drawings. Repair all cracks greater than 1/32-inch wide and all cracks that are clearly visible. Repair multiple hairline cracks, random cracking, and checking if combined effects in any way compromise plaster integrity. Architect will make final determination in questionable cases.

B. Preparation: Cut out crack to a minimum of 1/8-inch wide. Splay sides of crack outward towards the substrate to provide a slight dovetail. Brush crack clean of dust and dirt.

C. Bonding Compound: Apply bonding compound to all crack surfaces.

D. Filling: Fill crack with plaster patching compound. Repeat as necessary to provide surface matching plane of adjacent plaster surface.

E. Finished Surface: Surface shall show no signs of crack or crack repair after finish has been applied. Cut out work that does not meet requirements of these specifications and repeat patching to Architect's satisfaction.

3.6 FINISHING

A. Cut, patch, point-up and repair plaster as necessary to restore shrinkage cracks, dents and imperfections. Repair or replace work to eliminate blisters, buckles, excessive crazing and check cracking, dry-outs, efflorescence, sweat-outs and similar defects, and where bond to the substrate has failed. Patched surfaces in existing plaster surfaces shall be imperceptible.

B. Sand smooth-troweled finishes lightly to remove trowel marks and arrises.

C. Remove temporary protection and enclosure of other work. Remove plaster from other surfaces which are not to be plastered. Repair floors, walls and other surfaces which have been stained, marred or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers and equipment and clean floors of plaster debris.

D. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures plaster work being without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 092900

GYPSUM DRYWALL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the gypsum drywall as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Gypsum board work for partitions, ceilings, column enclosures, furring, and elsewhere where gypsum drywall work is shown on drawings.

2. Metal supports for gypsum drywall construction.

3. Acoustical insulation for gypsum drywall work.

4. Sealant for gypsum drywall work.

5. Concealed metal reinforcing for attachment of railings, toilet partitions and other items supported on drywall partitions and walls.

6. Taping and finishing of drywall joints.

7. Installing rings and frames in drywall surfaces for grilles, registers and lighting fixtures.

8. Gypsum shaftwall construction.

9. Bracing and connections.

1.3 RELATED SECTIONS

A. Hollow metal door frames - Section 081113.

B. Access doors - Section 083113.

C. Painting - Section 099000.

D. Rings for grilles, registers and light fixtures - Division 23 and 26.

1.4 QUALITY ASSURANCE

A. The following standards, as well as other standards which may be referred to in this Section, shall apply to the work of this Section:

1. The Gypsum Construction Handbook, latest edition, USG.

2. Construction Guide, latest edition, National Gypsum.

3. ASTM A 568 "Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements For"

4. ASTM C 475 "Standard Specification for Joint Treatment Materials for Gypsum Wallboard Construction"

5. ASTM C 645 "Standard Specification for Non-Structural Steel Framing Members"

6. ASTM C 754 "Standard Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products"

7. ASTM C 840 "Standard Specification for Application and Finishing of Gypsum Board"

8. ASTM C 919 "Standard Specification for Use of Sealants in Acoustical Applications"

9. ASTM C 954 "Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs From 0.033 in. to 0.112 in. in Thickness"

10. ASTM C 1002 "Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Board"

11. ASTM C 1177 "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing"

12. ASTM C 1178 "Standard Specification for Glass Mat Water Resistant Gypsum Backing Board"

13. ASTM C 1278 "Standard Specification for Fiber-Reinforced Gypsum Panel"

14. ASTM C 1396 "Standard Specification for Gypsum Board"

15. ASTM D 3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber"

B. Allowable Tolerances: 1/32" offsets between planes of board faces, and 1/16" in 8'-0" for plumb, level, warp and bow.

C. System Design Load

1. Provide standard drywall wall assemblies designed and tested by manufacturer to withstand a lateral load of 5 lbs. per sq. ft. for the maximum wall height required, and with deflection limited to L/240 of partition height.

   a. Drywall assemblies with tile finish shall have a deflection limit of L/360.

2. Provide drywall ceiling assemblies designed, fabricated and installed to have a deflection not to exceed L/360.

D. Fire-Resistance Rating: Where gypsum drywall with fire resistance ratings are indicated, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories, or to design designations in UL "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction, and compliant with UL Test #2079; criteria for cycle movement for all field height wall sections requiring allowance for vertical deflection within framing details.

E. Installer: Firm with not less than 5 years of successful experience in the installation of specified materials.

F. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance program.

1.5 SUBMITTALS

A. Submit shop drawing for each drywall partition, furring and ceiling system showing size and gauges of framing members, hanger and anchorage devices, wallboard types, insulation, sealant, methods of assembly and fastening, control joints indicating column lines, corner details, joint finishing and relationship of drywall work to adjacent work.

B. Samples: Each material specified herein, 12" x 12", or 12" long, or in manufacturer's container, as applicable for type of material submitted.

C. Manufacturer's Literature: Submit technical and installation instructions for each drywall partition, furring and ceiling system specified herein, and for each fire-rated and sound-rated gypsum board assembly. Submit other data as required to show compliance with these specifications, including data for mold resistant joint compound.

D. Test Reports: This Contractor shall submit test report, obtained by drywall manufacturer, indicating conformance of drywall assemblies to required fire ratings and sound ratings.

E. Evaluation Reports: Submit evaluation reports certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98, IAS Accreditation Criteria for Inspection Agencies.

1.6 PRODUCT HANDLING AND PROTECTION

A. Deliver, store and handle drywall work materials to prevent damage. Deliver materials in their original, unopened containers or bundles, and store where protected from moisture, damage and from exposure to the elements. Store wallboard in flat stacks.

B. Protect wallboard from becoming wet.

C. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".

1.7 ENVIRONMENTAL CONDITIONS

A. Provide and maintain minimum temperature of fifty-five (55) degrees F. and adequate ventilation to eliminate excessive moisture within the building in the area of the drywall work for at least twenty-four (24) hours, prior to, during and after installation of drywall work. Installation shall not start until windows are glazed and doors are installed, unless openings are temporarily closed. Space above suspended ceilings shall be vented sufficiently to prevent temperature and pressure build up.

1.8 JOB MOCK-UP

A. At a suitable location, where directed by the Architect, lay up a portion of a finished wall and ceiling demonstrating the quality of work, including finishing, to be obtained under this Section. Omit drywall boards in locations as directed by the Architect to show stud spacing and attachments; after acceptance, complete assembly.

B. Adjust the finishing techniques as required to achieve the finish required by the Architect as described in this Section of these specifications.

C. Upon approval of the mock-up, the mock-up may be left in place as a portion of the finished work of this Section.

D. All drywall work shall be equal in quality to approved mock-up.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers for Gypsum Drywall Panels and Accessories: U.S. Gypsum Co., Georgia Pacific, CertainTeed Corporation, Continental Building Products, or National Gypsum Co. meeting specification requirements are acceptable.

1. All drywall products must be manufactured in North America.

B. Acceptable Manufacturers for Metal Supports of Drywall Assemblies: Unless otherwise noted, provide products manufactured by ClarkDietrich, Super Stud Building Products, or Marino/Ware.

2.2 METAL SUPPORTS

A. Metal Floor and Ceiling Runners

1. Drywall Track: Formed from 0.0312 inch (20 U.S. Std. gauge) (minimum unless otherwise noted or required by performance requirements) cold formed steel, width to suit shaped metal studs. Use 20 ga. top runners with 1-1/4" minimum flanges.

2. Deflection track or head of wall connections at rated partitions shall conform to UL #2079 for cycle movement. Provide positive mechanical connection of framing to structure, allowing for vertical movement within connections. Minimum of 0.0312 (20 ga.) cold formed steel for clips, 25 ga. cold formed steel for deflection track.

   a. Product: ClarkDietrich; [BlazeFrame DSL] [MaxTrak] Slotted Deflection Track as manufactured by the Steel Network, VertiClip or VertiTrack or comparable product made by Metal-Lite Inc.
   b. FireTrak (including stud clips) by FireTrak Corp. or comparable product made by Metal-Lite Inc.

3. Shaft Wall "J" Type Runner: Formed from 0.0329 inch (20 U.S. Std. gauge) galvanized steel, 1" x 2-1/2" or 4" wide (to suit detail) x 2-1/4" (for shaft wall).

B. Metal Studs, Framing and Furring

1. C-Shaped Studs: Channel type with holes for passage of conduit formed from minimum 0.0312 inch (20 U.S. Std. gauge) (unless heavier gauge is required to meet deflection limits) cold formed steel, width as shown on drawings.

2. Furring Channels: Hat shaped, formed from galvanized steel, 25 U.S. Std. gauge.

   a. Product: ClarkDietrich; Furring Channel, or comparable product.

3. "C-H," "CT," or "I" Type Stud: 1-1/2" x 2-1/2", 4" or 6" wide (to suit detail) galvanized steel. Use for shaft wall construction; gauge and size as required to meet deflection limits given herein.

   a. Product: ClarkDietrich; CT Stud, or a comparable product.

4. Double "E" Type Stud or "J" Track with Holding Tabs: 1" x 2-1/2", 4" or 6" wide (to

suit detail) galvanized steel. Use for shaft wall construction; gauge and size as required to meet deflection limits given herein.

a. Product: ClarkDietrich; J-Tabbed Track, or a comparable product.

5. Continuous 16 gauge x 8" wide steel wall plate screwed to studs as required for support of railings, toilet partitions and other items supported on drywall partitions and walls.

C. Suspended Ceiling and Fascia Supports

1. Main Runners: 1-1/2" steel channels, cold rolled at 0.475 lbs. per ft., rust-inhibitive paint finish.

2. Furring Members: Screw-type hat-shaped furring channels of 25 ga. zinc-coated steel; comply with ASTM C 645.

3. Hangers: Galvanized, 1" x 3/16" flat steel slats capable of supporting 5x calculated load supported.

4. Hanger Anchorages: Provide inserts, clips, bolts, screws and other devices applicable to the required method of structural anchorage for ceiling hangers. Size devices for 5x calculated load supported.

5. Furring Anchorages: 16 ga. galvanized wire ties, manufacturer's standard clips, bolts or screws as recommended by furring manufacturer.

D. Protective Coating: All cold-formed steel members shall have coating conforming to AISI S220; ASTM A 653, G60 or coating with equivalent corrosion resistance of ASTM A653/A653M, G60. Galvannealed products are not acceptable

2.3 GYPSUM WALLBOARD TYPES

A. Gypsum Wallboard: 1/2" thick and 5/8" thick as indicated on drawings, "Sheetrock" by USG, "Gold Bond" by National Gypsum, or "Regular Gypsum" by CertainTeed Corp., 48" wide, in maximum lengths available to minimize end-to-end butt joints.

B. Fire-Rated Gypsum Wallboard: 1/2" thick and 5/8" thick as indicated on drawings, "1/2" Sheetrock Firecode C" or 5/8" Sheetrock Ecosmart Firecode X by USG, "Firecheck Type C" by Lafarge/Continental, "Gold Bond Fireshield" by National Gypsum, or "Type C" and "Type X" by CertainTeed Corp., 48" wide, in maximum lengths available to minimize end-to-end butt joints.

C. Water-Resistant Backing Board for Tile Finish: 5/8" thick, "DUROCK Glass Mat Tile Backerboard" by USG, "Dens-Shield Tile Backer Board" by Georgia Pacific, or "DiamondBack Tile Backer" by CertainTeed Corp. Cover joints with a pressure sensitive woven glass fiber tape equal to Imperial Type P Tape.

D. Mold-Resistant Shaft Wall Liner: Solid gypsum board liner for shaft wall construction, 1" thick, 24" wide, as required to suit condition, by standard lengths as required, beveled edges. Provide "Mold Tough Liner Panel" by USG, "DensGlass Shaftliner" by Georgia Pacific, "Mold Defense Shaftliner Type X" and/or "Weather Defense Shaftliner Type X" by Lafarge/Continental, "Gold Bond Brand Fireshield Shaft Liner XP," "Gold Bond Brand EXP Extended Exposure Shaft Liner" by National Gypsum, or "M2Tech Shaftliner" by CertainTeed Corp.

1. Liner board must have a rating 10 per ASTM D 3273 with a core that meets ASTM C 1396 Section 6.

E. Abuse-Resistant Wallboard: 5/8" thick "Sheetrock Brand Mold Tough AR" by USG, "Dens Armor Plus Abuse Resistant Panels" by Georgia-Pacific, "EXP Interior Extreme AR" or "Gold Bond Brand Hi-Abuse XP" by National Gypsum, "Protecta AR100" or "Protecta HIR 300" by Lafarge/Continental, or "AirRenew Extreme Abuse" by CertainTeed Corp., 48" wide, in maximum lengths available to minimize end-to-end butt joints.

1. Board must achieve a Level 1 rating per ASTM C 1629.

F. Impact-Resistant Wallboard: 1/2" and 5/8" thick as indicated on drawings, "Sheetrock Brand Mold Tough VHI" by USG, "DensArmor Plus Impact-Resistant Panels" by Georgia-Pacific, "EXP Interior Extreme IR" or "Gold Bond Brand Hi-Impact XP" by National Gypsum, "Protecta HIR 300" by Lafarge/Continental, or "AirRenew Extreme Impact" by CertainTeed Corp., 48" wide, in maximum lengths available to minimize end-to-end butt joints.

G. Cement Board (for tile backer board in shower areas and wherever else scheduled): 1/2" thick "Durock Tile Backer Board" by USG, or "Wonder Board Lite" by Custom Building Products.

H. Sustainable/Lightweight Gypsum Wallboard: ASTM C 1396, "Sheetrock Brand Ecosmart (Type ULIX)" or "Sheetrock Brand Ecosmart Mold Tough" by USG or “High Strength Fireshield Lite XP” by National Gypsum.

2.4 ACCESSORIES

A. Acoustical Insulation: Paper-less, non-combustible, semi-rigid mineral fiber mat, 2" thick, in walls (unless otherwise indicated), 3 lb./cu. ft. maximum density; Thermafiber, Inc. (an Owens Corning company) "Thermafiber SAFB".

B. Fasteners for Wallboard: USG Brand Screws; Type S Bugle Head for fastening wallboard to lighter gauge interior metal framing (up to 20 ga.). Type S-12 Bugle Head for fastening wallboard to heavier gauge interior metal framing (20 ga. to 12 ga.); Type S and Type S-12 Pan Head for attaching metal studs to door frames and runners; and Type G Bugle Head for fastening wallboard to wallboard. Lengths specified below under "Part 3 - Execution" Articles and as recommended by drywall manufacturer.

1. For Portland cement base boards, fasteners shall be equal to Durock Steel Screws by U.S. Gypsum.

C. Laminating Adhesive: "Sheetrock Brand Joint Compound."

D. Metal Trim - Corner Beads: For 90 degree External Corners - ClarkDietrich; 103 Deluxe Cornerbead or "Dur-A-Bead" No. 103, 26 U.S. Std. ga. galvanized steel, 1-1/4" x 1-1/4", for 90 degree external corners.

E. Metal Trim - Edge Beads: "Sheetrock Brand Paper Faced Metal Bead and Trim."

F. Partition/Concrete Ceiling Trim: Trim-Tex Super Seal Tear Away.

G. Metal Trim Treatment Materials and Joint Treatment Materials for Gypsum Drywall Boards: Paper tape for joint reinforcing; Setting Type (Durabond 90) or Lightweight Setting Type Joint Compound for taping and topping; and Ready Mix Compound for finishing.

1. For mold-resistant drywall, water resistant drywall, and tile backer board, use glass mesh tape with setting joint compound that is rated 10 when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274.

H. Control Joints: ClarkDietrich; #093 Control Joint or No. 0.093, USG.

I. Acoustical Sealant: Subject to compliance with requirements, provide one of the following:

1. USG; Acoustical Sealant

2. Tremco Mfg. Co.; Tremco Acoustical Caulking

3. BASF; Masterseal NP520

J. Neoprene Gaskets: Conform to ASTM D 1056.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where gypsum drywall is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. General

1. Install drywall work in accordance with drywall manufacturer's printed instructions and as indicated on drawings and specified herein.

2. All metal framing for drywall partitions shall extend from floor to underside of structural deck above. Provide for vertical deflection with positive mechanical connections of framing members to structure.

3. Provide concealed reinforcement, 16 ga. thick by eight (8) inches wide or as detailed or as recommended by manufacturer, for attachment of railings, toilet partitions, and other items to be supported on the partitions which cannot be attached to the metal framing members. Concealed reinforcement shall span between metal studs and be attached thereto using two (2) self-tapping pan head screws at each stud.

a. Back of drywall shall be scored or notched to prevent bulging out where reinforcement plate occurs.

B. Fire-Rated Assemblies: Install fire-rated assemblies in accordance with requirements of authorities having jurisdiction, Underwriters' Laboratories and test results obtained and published by the drywall manufacturer, for the fire-rated drywall assembly types indicated on the drawings.

C. Acoustical Assemblies: Install acoustically-rated assemblies to achieve a minimum STC as noted on drawings, in accordance with test results obtained and published by the drywall manufacturer, for the drywall assembly type indicated on the drawings.

D. Sealant

1. Install continuous acoustical sealant bead at top and bottom edges of wallboard where indicated or required for sound rating as wallboard is installed, and between metal trim edge beads and abutting construction.

2. Install acoustical sealant in 1/8" wide vertical control joints within the length of the

wall or partitions, and in all other joints, specified below under "Control Joints." Install bead of acoustical sealant around electric switch and outlet boxes, piping, ducts, and around any other penetration in the wallboard; place sealant bead between penetrations and edge of wallboard.

3. Where sealant is exposed to view, protect adjacent surfaces from damage and from sealant material, and tool sealant flush with and in same plane as wallboard surface. Sealant beads shall be 1/4" to 3/8" diameter.

E. Wallboard Application

1. Do not install wallboard panels until steel door frames are in place; coordinate work with Section 081113, "Steel Doors and Frames."

2. See drawings for all board types. Use fire-rated wallboard for fire-rated assemblies. Use water-resistant wallboard where indicated on drawings and where wallboard would be subject to moisture. Install water-resistant wallboard in full, large sheets (no scraps) to limit number of butt joints.

3. Apply wallboard with long dimension parallel to stud framing members, and with abutting edges occurring over stud flanges.

4. Install wallboard for partitions from floor to underside of structure above and secure rigidly in place by screw attachment, unless otherwise indicated.

5. Provide "Thermafiber" safing insulation meeting standards of Section 078413 at flutes of metal deck where partitions carry up to bottom of metal deck.

6. Neatly cut wallboard to fit around outlets, switch boxes, framed openings, piping, ducts, and other items which penetrate wallboard; fill gaps with acoustic sealant.

7. Where wallboard is to be applied to curved surfaces, dampen wallboard on back side as required to obtain required curve. Finish surface shall present smooth, even curve without fluting or other imperfections.

8. Screw fasten wallboard with power-driven electric screw driver, screw heads to slightly depress surface of wallboard without cutting paper, screws not closer than 3/8" from ends and edges of wallboard.

9. Where studs are doubled-up, screw fasten wallboard to both studs in a staggered pattern.

F. Cementitious Backer Board

1. General: Furnish cementitious backer board in maximum available lengths. Install horizontally, with end joints over framing members.

2. Fastening: Secure cementitious backer board to each framing member with screws spaced not more than 12 inches on center and not closer than 1/2" from the edge. Install screws with a conventional screw gun so that the screw heads are flush with the surface of the board.

3. Joint Treatment: Fill space between edge of backer and receptor with dry-set Portland cement or latex-Portland cement mortar. Fill all horizontal and vertical joints and corners with dry-set Portland cement or latex-Portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.

G. Metal Trim: Install and mechanically secure in accordance with manufacturer's

instructions; and finish with three (3) coats of joint compound, feathered and finish sanded smooth with adjacent wallboard surface, in accordance with manufacturer's instructions.

1. Corner Beads: Install specified corner beads in single lengths at all external corners, unless corner lengths exceed standard stock lengths.

2. Edge Beads: Install specified edge beads in single lengths at all terminating edges of wallboard exposed to view, where edges abut dissimilar materials, where edges would be exposed to view, and elsewhere where shown on drawings. Where indicated on drawings, seal joint between metal edge bead and adjoining surface with specified gasket, 1/8" wide minimum and set back 1/8" from face of wallboard, unless other size and profile indicated on drawings.

3. Casing beads shall be set in long lengths, neatly butted at joints. Provide casing beads at juncture of board and vertical surfaces and at exposed perimeters.

H. Control Joint Locations: Gypsum board surfaces shall be isolated with control joints where:

1. Ceiling abuts a structural element, dissimilar wall or other vertical penetration.

2. Construction changes within the plane of the partition or ceiling.

3. Shown on approved shop drawings.

4. Ceiling dimensions exceed thirty (30) feet in either direction.

5. Wings of "L," "U," and "T" shaped ceiling areas are joined.

6. Expansion or control joints occur in the structural elements of the building.

7. Shaftwall runs exceed 30' without interruption.

8. Partition or furring abuts a structural element or dissimilar wall or ceiling.

9. Partition or furring runs exceed 30' without interruption.

10. Where control joints are required, ceiling height door frames may be used as control joints. Less than ceiling height frames shall have control joints extending to the ceiling from both corners.

I. Joint Treatment and Spackling

1. Joints between face wallboards in the same plane, joints at internal corners of intersecting partitions and joints at internal corners of intersections between ceilings and walls or partitions shall be filled with joint compound.

2. Screw heads and other depressions shall be filled with joint compound. Joint compound shall be applied in three (3) coats, feathered and finish surface sanded smooth with adjacent wallboard surface, in accordance with manufacturer's instructions. Treatment of joints and screw heads with joint compound is alsorequired where wallboard will be covered by finish materials which require a smooth surface, such as vinyl wall coverings.

3.3 FURRED WALLS AND PARTITIONS

A. Use specified metal furring channels. Run metal furring channel framing members vertically, space sixteen (16) inches o.c. maximum. Fasten furring channels to concrete or masonry surfaces with power-driven fasteners or concrete stub nails spaced sixteen (16) inches o.c. maximum through alternate wing flanges (staggered) of furring channel.

Furring channels shall be shimmed as necessary to provide a plumb and level backing for wallboard. At inside of exterior walls, an asphalt felt protection strip shall be installed between each furring channel and the wall. Furring channel and splices shall be provided by nesting channels at least eight (8) inches and securely anchoring to concrete or masonry with two (2) fasteners in each wing.

B. Wallboard Installation: Same as specified under Article 3.4 - "Metal Stud Partitions."

3.4 METAL STUD PARTITIONS

A. Unless otherwise noted, steel framing members shall be installed in accordance with ASTM C 754.

B. Runner Installation: Use channel type. Align accurately at floor according to partition layout. Anchor runners securely sixteen (16) inches o.c. maximum with power-driven anchors to floor slab, with power-driven anchors to structural slab above. See "Stud Installation" below for runners over heads of metal door frames. Where required, carefully remove sprayed-on fireproofing to allow partition to be properly installed.

C. Stud Installation

1. Use channel type, positioned vertically in runners, spaced as noted on drawings, but not more than sixteen (16) inches o.c.

2. Anchor studs to floor runners with screw fasteners. Provide snap-in or slotted hole slip joint bolt connections of studs to ceiling runners leaving space for movement. Anchor studs at partition intersections, partition corners and where partition abuts other construction to floor and ceiling runners with sheet metal screws through each stud flange and runner flange.

3. Connection at ceiling runner for non-rated partitions shall be snap-in or slotted hole slip joint bolt connection that shall allow for movement. Seal studs abutting other construction with 1/8" thick neoprene gasket continuously between stud and abutting construction.

4. Connections for fire rated partitions at ceiling runners shall conform to UL Design #2079.

5. Install metal stud horizontal bracing wherever vertical studs are cut or wallboard is cut for passage of pipes, ducts or other penetrations, and anchor horizontal bracing to vertical studs with sheet metal screws.

6. At jambs of door frames and borrowed light frames, install doubled-up studs (not back to back) from floor to underside of structural deck, and securely anchor studs

to jamb anchors of frames and to runners with screws. Provide cross braces from hollow metal frames to underside of slab.

7. Over heads of door frames, install cut-to-length section of runner with flanges slit and web bent to allow flanges to overlap adjacent vertical studs, and securely anchor runner to adjacent vertical studs with sheet metal screws. Install cut-to- length vertical studs from runner (over heads of door frame) to ceiling runner sixteen (16) inches maximum o.c. and at vertical joints of wallboard, and securely anchor studs to runners with sheet metal screws.

8. At control joints, in field of partition, install double-up studs (back to back) from floor to ceiling runner, with 1/4" thick continuous compressible gasket between studs.

When necessary, splice studs with eight (8) inches minimum nested laps and attach flanges together with two (2) sheet metal screws in each flange. All screws shall be self-tapping sheet metal screws.

D. Runners and Studs at Chase Wall: As specified above for "Runners" and "Studs" and as specified herein. Chase walls shall have either a single or double row of floor and ceiling runners with metal studs sixteen (16) inches o.c. maximum and positioned vertically in the runners so that the studs are opposite each other in pairs with the flanges pointing in the same direction. Anchor all studs to runner flanges with sheet metal screws through each stud flange and runner flange following requirements of paragraph 3.4, B. Provide cross bracing between the rows of studs by attaching runner channels or studs set full width of chase attached to vertical studs with one self-tapping screw at each end. Space cross bracing not over thirty-six (36) inches o.c. vertically.

E. Wallboard Installation - Single Layer Application (Screw Attached)

1. Install wallboard with long dimension parallel to framing member and with abutting edge joints over web of framing member. Install wallboard with long dimension perpendicular to framing members above and below openings in drywall extending to second stud at each side of opening. Joints on opposite sides of wall shall be arranged so as to occur on different studs.

2. Boards shall be fastened securely to metal studs with screws as specified. Where a free end occurs between studs, back blocking shall be required. Center abutting ends over studs. Correct work as necessary so that faces of boards are flush, smooth, true.

3. Wallboard screws shall be applied with an electric screw gun. Screws shall be driven not less than 3/8" from ends or edges of board to provide uniform dimple not over 1/32" deep. Screws shall be spaced twelve (12) inches o.c. in the field of the board and 8" o.c. staggered along the abutting edges.

4. All ends and edges of wallboard shall occur over screwing members (studs or furring channels). Boards shall be brought into contact but shall not be forced into place. Where ends or edges abut, they shall be staggered. Joints on opposite sides of a partition shall be so arranged as to occur on different studs.

5. At locations where piping receptacles, conduit, switches, etc., penetrate drywall partitions, provide non-drying sealant and an approved sealant stop at cut board locations inside partition.

F. Wallboard Installation - Double-Layer Application

1. General: See drawings for wallboard partition types required.

2. First Layer (Screw Attached): Install as described above for single layer application.

3. Second Layer (Screw Attached): Screw attach second layer, unless laminating method of attachment indicated on drawings or necessary to obtain required sound rating or fire rating. Install wallboard vertically with vertical joints offset thirty-two (32) inches from first layer joints and staggered on opposite sides of wall. Attach wallboard with 1-5/8" screws sixteen (16) inches o.c. along vertical joints and sixteen (16) inches o.c. in the field of the wallboard. Screw through first layer into metal framing members.

4. Second Layer (Laminated): Install wallboard vertically. Stagger joints of second layer from first layer joints. Laminate second layer with specified laminating

adhesive in beads or strips running continuously from floor to ceiling in accordance with manufacturer's instructions. After laminating, screw wallboard to framing members with 1-5/8" screws, spaced twelve (12) inches o.c. around perimeter of wallboard.

G. Wallboard Installation - Laminated Application: Where laminated wallboard is indicated, use specified laminating adhesive, install wallboard vertically and maintain tolerances as specified for screw attached wallboard.

H. Insulation Installation: Install where indicated on drawings. Place blanket tightly between studs.

I. Deflection of Structure Above: To allow for possible deflection of structure above partitions, provide top runners for non-rated partitions with 1-1/4" minimum flanges and do not screw studs or drywall to top runner. Where positive anchorage of studs to top runner is required, anchorage device shall be by means of slotted hole (in clip connection with screw attachment to web of steel through bushings located in slots of clips), or other anchorage device approved by Architect.

J. Control Joints

1. Leave a 1/2" continuous opening between gypsum boards for insertion of surface mounted joint.

2. Back by double framing members.

3. Attach control joint to face layer with 9/16" galvanized staples six (6) inches o.c. at both flanges along entire length of joint.

4. Provide two (2) inch wide gypsum panel strip or other adequate seal behind control joint in fire rated partitions and partitions with safing insulation.

3.5 DRYWALL FASCIAS AND CEILINGS

A. Furnish and install inserts, hanger clips and similar devices in coordination with other work.

B. Secure hangers to inserts and clips. Clamp or bolt hangers to main runners.

C. Space main runners 4'-0" o.c. and space hangers 4'-0" o.c. along runners, except as otherwise shown.

D. Level main runners to a tolerance of 1/4" in 12'-0", measured both lengthwise on each runner and transversely between parallel runners.

E. Metal Furring Channels: Space sixteen (16) inches o.c. maximum. Attach to 1-1/2" main runner channels with furring channel clips (on alternate sides of main runner channels). Furring channels shall not be let into or come in contact with abutting masonry walls. End splices shall be provided by nesting furring channels no less than eight (8) inches and securely wire tying. At any openings that interrupt the furring channels, install additional cross reinforcing to restore lateral stability.

F. Mechanical accessories, hangers, splices, runner channels and other members used in suspension system shall be of metal, zinc coated, or coated with rust inhibitive paint, of suitable design and of adequate strength to support units securely without sagging, and such as to bring unit faces to finished indicated lines and levels.

1. Provide special furring where ducts are over two (2) feet wide.

G. Apply board with its long dimension at right angles to channels. Locate board butt joints over center of furring channels. Attach board with one (1) inch self-drilling drywall screws twelve (12) inches o.c. in field of board at each furring channel; eight (8) inches o.c. at butt joints located not less than 3/8" from edges.

3.6 SHAFT WALLS

A. Runner Installation: Use "J" metal runners at floor and ceiling, with the short leg toward finish side of wall. Securely attach runners to structural supports with power-driven fasteners at both ends and twenty-four (24) inches o.c.

B. Shaft Wall Liner: Cut shaft wall liner panels one (1) inch less from floor to ceiling height and erect vertically between J-runners.

C. C-H Studs: Cut metal studs 3/8" to not more than 1/2" less than floor to ceiling height and install between shaft wall liner panels so that panels are fitted snugly into the one (1) inch wide "H," "T," or "I" portion of the stud. Space studs twenty-four (24) inches o.c., unless otherwise indicated on drawings. Install full-length steel E-Studs or J-runners vertically at T-intersections, corners, door jambs, and columns. Install full length E-Studs or J-runners over shaft wall liner both sides of closure panels. Frame openings cut within a liner panel with J-Runner around perimeter. For openings, frame with vertical E-Stud or J-runner at edges, horizontal runner at head and sill, and reinforcing as shown on the drawings. Suitably frame all openings to maintain structural support for wall. Install floor-to-ceiling steel E-Studs or J-runners each side of elevator door frames to act as strut-studs. Attach strut-stud to floor and ceiling runners with two (2) 3/8" Type S screws, space twelve (12) inches o.c. Over metal doors, install a cut to length section of runner and attach to strut-studs with clip angles and 3/8" Type S Screws space twelve (12) inches o.c.

D. Wallboard Installation - Double Layer Installation: Erect gypsum wallboard base layer vertically or horizontally to meet fire rating on one side of studs with end joints staggered. Fasten base layer panels to studs with one (1) inch Type S screws twenty-four (24) inches o.c. Caulk perimeter of base layer panels. Apply gypsum wallboard face layer vertically over base layer with joints staggered and attached with 1-5/8" Type S screws staggered from those in base, spaced eight (8) inches o.c. and driven into studs.

E. Wallboard Installation (Where Both Sides of Shaft Wall are Finished): Apply gypsum wallboard face layers vertically both sides of studs. Stagger joints on opposite partition sides. Fasten panels with one (1) inch or two (2) inches Type S screws spaced eight (8) inches o.c. in field and along edges into studs.

F. Where handrails are indicated for direct attachment to drywall shaft system, provide not less than a sixteen (16) ga. x eight (8) inches wide galvanized steel reinforcement strip, accurately positioned and secured to studs and concealed behind not less than one 1/2" thick course of gypsum board in the system.

G. Integrate stair hanger rods with drywall shaft system by locating cavity of system as required to enclose rods.

H. Horizontal Shaftwall Duct and Ceiling Assemblies: Provide I-stud cavity shaftwall system for horizontal duct protection consisting of I-studs 24" o.c. with 1" fire-rated shaft liner panels inserted in the stud tabs, and three layers of 1/2" firecode C gypsum board attached to the stud flanges opposite the shaft liner panels.

3.7 ERECTION AT COLUMN ENCLOSURES

A. Metal furring supports shall be provided under work of this Section, and shall be cut to lengths as necessary for tight fit such that spacing is not more than sixteen (16) inches o.c.

B. Board shall be fastened securely to supports with screws as specified. Place boards in position with minimum number of joints. Where free ends occur between supports, back-blocking or furring shall be required. Center abutting ends over supports. Correct work as necessary so that faces of boards are flush, smooth and true. Provide clips or cross furring for attachment as required.

C. All layers shall be screw attached to furring.

D. When column finish called for on drawings to be in the same plane as drywall finish layer, maintain even, level plane.

3.8 FINISHING

A. Taping: A thin, uniform layer of compound shall be applied to all joints and angles to be reinforced. Reinforcing tape shall be applied immediately, centered over the joint, seated into the compound. A skim coat shall follow immediately, but shall not function as a fill or second coat. Tape shall be properly folded and embedded in all angles to provide a true angle.

B. Filling: After initial coat of compound has hardened, additional compound shall be applied, filling the board taper flush with the surface. The fill coat shall cover the tape and feather out slightly beyond the tape. On joints with no taper, the fill coat shall cover

the tape and feather out at least four (4) inches on either side of the tape. No fill coat is necessary on interior angles.

C. After compound has hardened, a finishing coat of compound shall be spread evenly over and extending slightly beyond the fill coat on all joints and feathered to a smooth, uniform finish. Over tapered edges, the finished joint shall not protrude beyond the plane of the surface. All taped angles shall receive a finish coat to cover the tape and taping compound, and provide a true angle. Where necessary, sanding shall be done between coats and following the final application of compound to provide a smooth surface, ready for painting.

D. Fastener Depressions: Compound shall be applied to all fastener depressions followed, when hardened by at least two (2) coats of compound, leaving all depressions level with the plane of the surface.

E. Finishing Beads and Trim: Compound shall be applied to all bead and trim and shall be feathered out from the ground to the plane of the surface. When hardened, this shall be followed by two (2) coats of compound each extending slightly beyond the previous coat. The finish coat shall be feathered from the ground to the plane of the surface and sanded as necessary to provide a flat, smooth surface ready for decoration.

F. Except as otherwise noted, level of finish for surface exposed to view shall conform to Level 4 of ASTM C 840 and GA-214 of the Gypsum Association.

G. Drywall construction with defects of such character which will mar appearance of finished work, or which is otherwise defective, will be rejected and shall be removed and replaced at no expense to the Owner.

3.9 CLEANING AND ADJUSTMENT

A. At the completion of installation of the work, all rubbish shall be removed from the building leaving floors broom clean. Excess material, scaffolding, tools and other equipment shall be removed from the building.

B. Work shall be left in clean condition ready for painting or wall covering. All work shall be as approved by Architect.

C. Cutting and Repairing: Include all cutting, fitting and repairing of the work included herein in connection with all mechanical trades and all other trades which come in conjunction with any part of the work, and leave all work complete and perfect after all trades have completed their work.

3.10 PROTECTION OF WORK

A. Installer shall advise Contractor of required procedures for protecting drywall work from damage and deterioration during remainder of construction period.

END OF SECTION

SECTION 093000

CERAMIC TILE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the ceramic tile as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Ceramic mosaic floor tile.
2. Ceramic glazed wall tile and matching base.
3. Quarry tile floor and base tile.
4. Stone saddles.
5. Setting beds, grout and sealant.
6. Waterproofing membrane.

1.3 RELATED SECTIONS

A. Concrete - Section 033000.

B. Masonry - Section 042000.

C. Gypsum drywall - Section 092900.

1.4 REFERENCES

A. ANSI A108 Series/A118 Series - American National Standards for Installation of Ceramic Tile.

B. ANSI A136.1 - American National Standards for Organic Adhesives for Installation of Ceramic Tile.

C. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.

D. ASTM C 150 - Standard Specification for Portland Cement.

E. TCNA - Handbook for Ceramic, Glass and Stone Tile Installation; Tile Council of North America, latest 2021 Edition.

F. ISO 13007 - International Standards Organization; classification for Grout and Adhesives.

G. LFT Tile – Large Format Tile, tile 15” or larger in any one direction.

H. Stone Tile – Conform to requirements of MIA (Marble Institute of America) Dimension

Stone Design Manual.

1.5 QUALITY ASSURANCE

A. Qualifications of Installers: For cutting, installing and grouting of ceramic tile, use only thoroughly trained and experienced journeyman tile setters who are completely familiar with the requirements of this work, and the recommendations contained in the referenced standards, and the installers are Certified Ceramic Tile Installer (CTI) through the Ceramic Tile Education Foundation (CTEF) or Tile Installer Thin Set Standards (ITS) verification through the University of Ceramic Tile and Stone.

B. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with the following:

1. Manufacture all tile in accordance with Standard Grade Requirements of ANSI A137.1.

2. Glass tile must meet ANSI A137.2.

3. Install all ceramic tile in accordance with the recommendations contained in Handbook for Ceramic, Glass and Stone Tile Installation of the Tile Council of North America, Inc., latest edition noted herein and ANSI A108/A118/A136.

4. Stone tiles shall conform to the requirements of ASTM C1242.

C. Flooring surfaces shall have a minimum wet DCOF AcuTest value of 0.42 and tested per ANSI A326.3 Dynamic Coefficient of Friction of Hard Surface Flooring Materials.

1.6 SUBMITTALS

A. Samples

1. Before any ceramic tile is delivered to the job site, submit to the Architect sample panels, approx. 12" x 12", mounted on hardboard back-up with selected grout color for each color and pattern of ceramic tile and grout specified.

2. Submit 6" length of stone saddles.

3. Submit 12" x 12" samples of waterproofing membrane.

B. Master Grade Certificates: Prior to opening ceramic tile containers, submit to the Architect a Master Grade Certificate, signed by an officer of the firm manufacturing the ceramic tile used, and issued when the shipment is made, stating the grade, kind of tile, identification marks for tile containers, and the name and location of the project.

C. Mock-ups

1. At an area on the site where approved by the Architect, provide a mock-up ceramic tile installation.

a. Make the mock-up approximately 3’0” x 3’0” in dimension.
b. Provide one mock-up for each type, class, and color of installation required under this Section.
c. The mock-ups may be used as part of the Work, and may be included in the finished Work, when so approved by the Architect.
d. Revise as necessary to secure the Architect's approval.

2. The mock-ups, when approved by the Architect, will be used as datum for comparison with the remainder of the work of this Section for the purposes of acceptance or rejection.

3. If the mock-up panels are not permitted to be part of the finished Work, completely demolish and remove them from the job site upon completion and acceptance of the work of this Section.

1.7 PRODUCT HANDLING

A. Delivery and Storage

1. Deliver all materials of this Section to the job site in their original unopened containers with all labels intact and legible at time of use.

2. Store all materials under cover in a manner to prevent damage and contamination; store only the specified materials at the job site.

B. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.

C. Maintain temperatures at not less than 50 deg. F. in tiled areas during installation and for 7 days after completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

2. Obtain waterproof/crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Stone thresholds.

2. Waterproof membrane.

3. Metal edge strips.

2.2 TILE

A. Basis of Design: Daltile; Refer to Drawings.

B. Other Acceptable Manufacturers:

1. American Olean

2. United States Ceramic Tile Co.

3. Summitville Tiles Inc.

2.3 TRIM AND SPECIAL SHAPES

A. Provide external and internal corners, trim shapes at openings, and all other trim and special shapes to match the tile specified herein, as required by field conditions and drawing details.

2.4 STONE SADDLES

A. Provide sound stone saddles as selected by the Architect, minimum 3/4" thick, with an abrasive hardness of not less than 10.0, when tested in accordance with ASTM C 241. Cut saddle to fit jamb profile, honed finish.

2.5 MORTAR BED, BOND COAT AND GROUT

A. Portland Cement: ASTM C 150, Type I.

B. Hydrated Lime: ASTM C 207, Type S.

C. Sand: ASTM C 144, clean and graded natural sand.

D. Reinforcing for Mud Set Systems: 2" x 2" x 16/16 ga. welded wire mesh.

E. Latex Modified Mortar Bed

1. Laticrete 3701 Fortified Mortar Bed
2. MAPEI, Modified Mortar Bed
3. Pro Spec, Floor Mud with B-710 SBR Acrylic Additive.
4. SikaLevel 050 Rapid Slope

F. Latex – Portland Cement Bond Coat, complying with ANSI A118.4 and ISO 13007, C2ES1P1 with minimum compressive strength of 400 psi.

1. Laticrete, 254 Platinum
2. MAPEI, Keraflex Super.
3. Pro Spec – Permalastic System consisting of Permalastic Dryset Mortar and Permalastic Admixture
4. SikaTile 350 Flex Set

G. Improved Modified Cement Mortars, complying with ANSI 118.15 and ISO 13007, CSES1P1.

(Also for use with LFT Tile and Stone Tile)

1. Laticrete, MultiMax Lite
2. Mapei; Keraflex Super.
3. Pro Spec; StayFlex 590.
4. SikaTile 475 LHT Premium Set or SikaTile 500 LHT Lite (above products are lightweight and non-lightweight)

H. Wall and Base Tile

1. Over drywall use ANSI A136.1-1967 Organic Adhesive for installation of Ceramic Tile, Type I and ISO 13007 D2TE. Shear strength shall be 50 psi minimum. Adhesive primer as recommended by adhesive manufacturer. Manufacturer shall certify, in writing, that adhesive and primer used are proper types for the intended tile types and application. Conform to TCNA Detail W-242.

   a. Laticrete Premium 15 Adhesive.
   b. MAPEI Type 1 Mastic.
   c. ProSpec B-1000 Tile Adhesive

2. Over masonry and concrete use a mortar bed leveling coat conforming to ANSI A108.1A followed by a Latex Portland Cement Bond Coat, Laticrete TriLite, MAPEI, Keraflex Super, SikaTile 475 LHT Premium Set or SikaTile 500 LHT Lite

and for non-LHT SikaTile 350 Flex Set or equal by Pro Spec, conforming to ANSI A118.4, ISO 13007-C2ES1P1, and TCNA Detail W-211.

3. Over cement board use a Latex Portland cement mortar bond coat, Laticrete TriLite, MAPEI, Keraflex Super, SikaTile 475 LHT Premium Set or SikaTile 500 LHT Lite and for non-LHT SikaTile 350 Flex Set or equal by Pro Spec, conforming to ANSI A118.4, ISO 13007-C2ES1P1, and TCNA Detail W-244; coat board with waterproof membrane as specified below.

4. Over glass mat water resistant gypsum backer board use a Latex Portland cement mortar bond coat, Laticrete TriLite, MAPEI, Keraflex Super, SikaTile 475 LHT Premium Set or SikaTile 500 LHT Lite and for non-LHT SikaTile 350 Flex Set or equal by Pro Spec, conforming to ANSI A118.4, ISO 13007-C2ES1P1, and TCNA Detail W-245.

I. Floor Tile and Stone Saddle - Waterproof Setting Bed: Set floor tile and stone saddle using thin set latex Portland cement bond coat, Basis of Design, Laticrete 254 Platinum, MAPEI, Keraflex Super SikaTile 350 Flex Set conforming to ANSI A118.4, ISO 13007-C2ES1P1, and waterproofing membrane conforming to TCNA Detail F-122/122A.

1. For installation of (LFT and Stone Tile), Improved Modified Cement Mortars and medium bed, Basis of Design, Laticrete MultiMax Lite, MAPEI, Ultraflex LFT SikaTile 475 LHT Premium Set or SikaTile 500 LHT Lite, conforming to ANSI 118.15, ISO 13007-C2ES1P1.

J. Waterproofing Membrane complying with ANSI A118.10 and ANSI A118.12; and having IAPMO certification as a shower pan liner: “Hydro Ban” made by Laticrete International, “Mapelastic Aquadefense” by MAPEI with factory blended “Bio-Block Antimicrobial”, SikaTile 100 Moisture Guard or ProSpec B6000.

1. Reinforce membrane with polyester fabric where recommended by manufacturer.

K. Showers: B-415 with waterproof membrane full height.

L. Water: Clean, fresh and suitable for drinking.

M. Grout complying with A118.7; and ISO 13007, CG2WAF: For grouting ceramic tile, provide a commercial Portland cement grout “Laticrete PermaColor or Laticrete PermaColor Select”, SikaTile 815 Secure Grout or “Ultracolor Plus FA” (additive not required) made by MAPEI; (addition not required); color as selected by the Architect.

N. Physical Properties: The setting beds and grouts must meet the following physical requirements:

1. Compressive Strength – 3000 psi min.

2. Shear Bond Strength – 500 psi min.

3. Water Absorption – 4.0% max.

4. Service Rating (ASTM C 627) – Extra Heavy Duty.

O. Sealer: Seal all grout joints and all unglazed tile using “StoneTech Heavy Duty Sealer” by Laticrete, “Sealer’s Choice 15 Gold” by Aqua Mix Inc or “Ultracare Penetrating Plus Stone, Tile, and Grout Sealer” by MAPEI. Merkrete Grout Sealer

P. Temporary Protective Coating: Either product indicated below that is applied in the tile manufacturer’s factory and formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, applied hot, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg. F. per ASTM D 87.

2. Grout release in form of manufacturer’s standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

Q. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, equal to “StoneTech Stone & Tile Cleaner” by Laticrete, “Concentrated Stone & Tile Cleaner” made by Aqua-Mix, “Ultracare Concentrated Tile & Grout Cleaner” by MAPEI, or approved equal, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.6 SEALANT

A. Joint Backing: Preformed, compressible, resilient, non-extruding, non-staining strips of foam neoprene, foam polyethylene, or other material recommended by sealant manufacturer.

B. Bond Breaker: Polyethylene tape, 3 mils thick or other material recommended by sealant manufacturer.

C. Sealant Primer: Colorless, non-staining, or type to suit substrate surface, as recommended by sealant manufacturer.

D. Sealant: One-part silicone based sanitary sealant, conforming to ASTM C 920, Type S, Grade NS, Class 25. Sealant hardness upon full cure shall be between 20-30 Shore "A" Durometer. Color of sealant to blend with or match adjacent materials, and as selected by the Architect. Sealant shall be equivalent to 1700 Sanitary Sealant made by General Electric or approved equal.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where ceramic tile is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 CONDITION OF SURFACES

A. Allowable Variations in Substrate Levels

1. Floors: + 1/8" in 10'-0" distance and 1/4" total max. variation from levels shown.

B. Grind or fill concrete and masonry substrates as required to comply with allowable variations.

C. Concrete substrates must meet ANSI A108.01 tolerances and surface textures in preparation for tile work; coordinate with concrete trades.

3.3 PREPARATION

A. Coordinate the following with Section 033000:

1. Steel trowel and fine broom finish concrete slabs that are to receive ceramic tile. Cure concrete slabs that are to receive tile before tile application. Do not use liquid curing compounds or other coatings that may prevent bonding of tile setting materials to slabs. Slab shall be dry at time of tile installation.

2. Tile floors with floor drains must have a slope to direction of 1/4” per foot; coordinate this with concrete trades.

B. Etch concrete substrate as may be required to remove curing compounds or other substances that would interfere with proper bond of setting bed. Rinse with water to remove all traces of treatment. Surface must meet finish requirements as noted in ANSI 108.01.

C. Blending: for tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at project site before installing.

D. Field Applied Temporary Protective Coating: Pre-coat tile with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.4 JOINTS IN TILE WORK

A. Joint Widths: 1/16" wide in ceramic tile.

B. Alignment: Wall, base and floor joints shall align through the field and trim. Direction and location of all joints as directed by Architect.

C. Movement Joints: Conform to TCNA Detail EJ171. Locate where movement joints are in back-up material. Provide movement joint at joints between mop receptors and ceramic tile. Provide movement joint at all vertical internal joints of wall tile. Movement joints 1/8" wide in ceramic tile. Fill all movement joints with specified backing and sealant. Use bond breaker where sufficient space for joint backing does not exist.

1. Provide sealant between ceramic tile and plumbing fixtures, mirrors, pipes, countertops and other dissimilar materials penetrating or adjacent to ceramic tile.

3.5 INSTALLATION

A. Comply with the following installation standards

1. Wall tile over drywall using organic adhesive - ANSI A136.1 and ISO 13007, D2TE.

2. Wall tile over cement board or glass mat backer board using dry set mortar with latex additive - ANSI A118.4 and ISO 13007, C2ES1P1.

3. Wall tile over masonry or concrete using dry set mortar with latex additive - ANSI A118.4 and ISO 13007, C2ES1P1.

4. Floor tile using full mud set mortar - ANSI A118.4, A228.15, and ISO 13007, C2ES1P1.

5. Floor tile using dry set mortar with latex additive - ANSI A118.4, A118.15, and ISO 13007, C2ES1P1.

6. Floor tile over waterproofing membrane.- A118.15, and ISO 13007, C2ES1P1.

B. Backs of tile must be cleaned before installation.

C. All setting beds and/or adhesives shall provide for an average contact area of not less than 95% coverage.

D. Allowable Variations in Finished Work: Do not exceed the following deviations from level and plumb, and from elevations, locations, slopes and alignment shown.

1. Floors: 1/8" in 10'-0" run, any direction; +/- 1/8" at any location; 1/32" offset at any location.

2. Walls: 1/8" in 8'-0" run, any direction; 1/8" at any location; offset at any location, 1/32".

3. Joints: +/- 1/32" joint width variation of any location; 1/16" in 3'-0" run deviation from plumb and true.

E. Waterproofing Membrane

1. Install the membrane in strict accordance with manufacturer's written recommendations.

2. Upon completion of work, test horizontal membrane for leaks by flood testing per ASTM D 5957. Inspect for leakage. Make necessary adjustments to stop all leakage and retest until watertight. If membrane is not covered by another surface immediately, provide protection until membrane is covered.

F. Handle, store, mix and apply setting and grouting materials in compliance with the manufacturer's instructions.

G. Extend tile work into recesses and under equipment and fixtures, to form a complete covering without interruptions. Terminate work neatly at obstructions, edges and corners without disruption of pattern or joint alignment.

H. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight, aligned joints. Fit tile closely to electrical outlets, piping and fixtures so that plates, collars, or covers overlap tile.

I. Lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are the same size. Lay out tile work and center tile fields both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths.

3.6 INSTALLATION OF STONE SADDLES

A. Install stone saddles cut to profiles and sizes shown, accurately fitted to jambs, coped at stops, set in full bed of mortar herein specified, and with grouted edge joints as specified for floor tile.

3.7 CLEANING AND PROTECTION

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use cleaners only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning to ensure removal of all cleaning material.

3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with Kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. Apply coat of sealer to all grout joints and all unglazed tile.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings from tile surfaces.

E. Leave finished installation clean and free of cracked, chipped, broken, unbonded or otherwise defective tile work.

END OF SECTION

SECTION 095113

ACOUSTIC PANEL CEILINGS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the acoustic panel ceilings as shown on the drawings and/or specified herein, including but not limited to, the following:

1. Acoustical panel units.
2. Exposed "T" suspension system, including hangers and inserts.
3. Provisions for the installation of lighting fixtures, diffusers, grilles and similar items provided under other Sections.
4. Cutting, drilling, scribing and fitting as required for electro-mechanical penetrations.
5. Perimeter and column moldings, trim and accessories for acoustical ceilings.

1.3 RELATED SECTIONS

A. Metal deck - Section 053100.

B. Drywall ceilings - Section 092900.

C. Diffusers, grilles and related frames - Division 23.

D. Lighting fixtures - Division 26.

1.4 QUALITY ASSURANCE

A. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations published by the Ceilings and Interior Systems Construction Association (CISCA).

B. Qualifications of Installers

1. The suspended ceiling subcontractor shall have a record of successful installation of similar ceilings acceptable to Architect and shall be currently approved by the manufacturer of the ceiling suspension system.

2. For the actual fabrication and installation of all components of the system, use only personnel who are thoroughly trained and experienced in the skills required and completely familiar with the requirements established for this work.

C. The work is subject to the following standards:

1. ASTM C 635 "Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings," American Society for Testing and Materials.

2. ASTM C 636 "Standard Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels," American Society for Testing and Materials.

D. In addition to suspension system specified, provide seismic struts and seismic clips to meet seismic standards as required by prevailing Codes and Ordinances.

1.5 SUBMITTALS

A. Shop Drawings: Submit completely dimensioned ceiling layouts for all areas where acoustical ceilings are required, showing:

1. Any deviations from Architect’s reflected ceiling plan layouts, especially lighting fixture and dimensions. Also indicate if any light fixtures will not fit into Architect’s ceiling layout due to dimensional restrictions of field conditions.

2. Direction and spacing of suspension members and location of hangers for carrying suspension members.

3. Direction, sizes and types of acoustical units, showing suspension grid members, and starting point for each individual ceiling area.

4. Moldings at perimeter of ceiling, at columns and elsewhere as required due to penetrations or exposure at edge of ceiling tiles.

5. Location and direction of lights, air diffusers, air slots, and similar items in the ceiling plane.

6. Details of construction and installation at all conditions.

7. Materials, gauges, thickness and finishes.

B. Samples and Product Literature: Submit the following samples and related manufacturer’s descriptive literature.

1. Twelve (12) inch long sample of each components of suspension systems, including moldings.

2. Acoustical units — full size.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Do not install acoustical ceilings until wet-work in space is completed and nominally dry, work above ceilings has been completed, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, fire suppression system components, and partition system.

1.9 EXTRA STOCK

A. Extra Stock: Deliver stock of maintenance material to Owner. Furnish maintenance material matching products installed, packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Ceiling Units: Furnish quantity of full size units equal to 2.0% of amount installed.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

A. See finish schedule.

2.2 SUSPENSION SYSTEM

A. Provide exposed "T" suspension system, steel, with low sheen white baked enamel finish.

1. Basis of Design: Armstrong World Industries; Prelude XL 15/16"

2. Other Acceptable Manufacturers:

a. USG Interiors, Inc.
b. Chicago Metallic Corp.

B. The suspension system shall support the ceiling assembly shown on the drawings and specified herein, with a maximum deflection of 1/360 of the span, in accordance with ASTM C 635.

C. Provide min. 12 ga. galvanized wire hangers, soft annealed steel conforming to ASTM A 641, prestretched, Class 1 zinc coating, soft temper, size so that stress at 3 times

hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire.

D. Provide ceiling clips and inserts to receive hangers, type as recommended by suspension system manufacturer, sizes for pull-out resistance of not less than five (5) times the hanger design load, as indicated in ASTM C 635.

E. Suspension systems shall conform to ASTM C 635, intermediate duty.

2.3 PERIMETER TRIM

A. Provide “Axiom Soft Edge Perimeter Trim” by Armstrong World Industries, Inc. or approved equal.

B. Components: Edge trim system for suspended ceiling system, extruded aluminum alloy 6063 trim channel, 10' straight profiles; plus factory-welded and finished corners with 12" legs. Attachment to grid system is provided by the specially designed Axiom tee-bar connection clips (AXTBC) or hanging clips (AXHGC), which lock into specially designed bosses on the Axiom trim channel and are screw-attached to the web of the intersecting Armstrong suspension system members. Sections of trim are joined together using the Axiom splice plate (AX4SPLICE). Gypsum board interface, below the Axiom trim channel, is accomplished with the Axiom Bottom Drywall Trim.

1. Axiom-Profiled Decorative Profiles (Width x Height): Custom 8” Profile Height for Axiom Soft Edge Ripple design, AXSER product family. Available in straight and curved sections with special bosses formed for attachment to the Axiom tee-bar connection clip or hanging clip; commercial quality, extruded aluminum, factory-finished in (factory-applied baked polyester paint to match Armstrong) ( ) color; (CC-Chemical Conversation Coating for field painting); or (color custom paint finish color-matched to approved sample).

2. Axiom Splice Plate (AX4SPLICE): Galvanized steel finish; formed to fit into special bosses and locked in place with 4 factory-installed screws.

3. Axiom Tee-Bar Connection Clip (AXTBC): Galvanized steel (unfinished) (finish to match trim channel) formed to fit into special bosses and locked in place by factory-installed screws and attached to Armstrong (Prelude®) (Prelude Plus XL Fire Guard) (Suprafine®) (Interlude™) (Sonata™)(Silhouette®) (Trimlok®) (Prelude XL 360º Painted) (Drywall Furring System) suspension system members.

4. Axiom Hanging Clip (AXHGC): Commercial quality aluminum (unfinished) (finish to match trim channel) formed to lock into special bosses and attach to Armstrong (Prelude®) (Prelude Plus XL Fire Guard) (Suprafine®) (Interlude™) (Sonata™)(Silhouette®) (Trimlok®) (Prelude XL 360o Painted) (Drywall Furring System) suspension system members.

5. Axiom-Profiled Drywall Trim (AXDWT): Commercial quality extruded aluminum 10' straight sections finished with chemical conversion coating and formed to integrate with the Axiom-Profiled profile and to provide finished edge for 5/8" gypsum board, tape and finish with joint compound.

6. Axiom-Profiled Alignment Clip (AXALIGN): Commercial quality extruded aluminum 3" straight section finished with chemical conversion coating.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas where acoustic panel ceilings are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected to permit proper installation of the layout.

3.2 PREPARATION

A. Coordination: Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.

B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans.

3.3 INSTALLATION

A. Codes and Standards: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations and industry standards.

B. Install suspension systems to comply with ASTM C 636, with wire hangers supported only from building structural members. Locate hangers not more than 6" from each end and spaced 4'-0" along direct-hung runner, leveling to tolerance of 1/8" in 12'-0".

C. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age or elevated temperatures.

D. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum which are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal force by bracing, reinforcing, countersplaying or other equally effective means.

E. Install edge moldings at edges of each acoustical ceiling area, and at locations where edge of acoustical units would otherwise be exposed after completion of the work.

1. Secure moldings to building construction by fastening through vertical leg. Space holes not more than 3" from each end and not more than sixteen (16) inches o.c. between end holes. Fasten tight against vertical surfaces.

2. Level moldings with ceiling suspension system, to a level tolerance of 1/8" in 12'-0".

F. Install acoustical units in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

G. Install hold-down clips in toilet areas, and in areas where required by governing regulations; space 2'-0" o.c. on all cross tees.

H. Light fixtures or other ceiling apparatus shall not be supported from main beams or cross tees if their weight causes the total load to exceed the deflection capability of the ceiling suspension system. In such cases the load shall be supported by supplemental hangers furnished and installed by this Section of work.

I. Where fixture or ceiling apparatus installation causes eccentric loading on runners, provide stabilizer bars to prevent rotation.

3.4 ADJUST AND CLEAN

A. Clean exposed surfaces of acoustical ceilings, including trim, edge molding, and suspension members; comply with manufacturer's instructions for cleaning and touch- up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 096500

RESILIENT TILE FLOORING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the resilient tile flooring, as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Luxury vinyl tile.
2. Vinyl base.
3. Rubber stair treads, risers and nosings.
4. Transition strips.
5. Accessories.

1.3 RELATED SECTIONS

A. Concrete slab - Section 033000.

B. Gypsum board partitions - Section 092900.

1.4 QUALITY ASSURANCE

A. Qualifications of Installers: Use only personnel who are thoroughly trained and experienced in the skills required and completely familiar with the requirements established for this work.

1.5 SUBMITTALS

A. Manufacturer's Data: For information only, submit manufacturer's technical information and installation instructions for type of resilient tile.

B. Samples

1. Submit full-size sample tiles for each type and color required, representative of the expected range of color and pattern variation. Sample submittals will be reviewed for color, texture and pattern only. Compliance with all other requirements is the exclusive responsibility of the Contractor.
2. Submit six (6) inch long samples of strips.

C. Submit manufacturer's warranty as noted herein.

1.6 DELIVERY AND STORAGE

A. Deliver materials to the project site in the manufacturer's original unopened containers, clearly marked to indicate pattern, gauge, lot number and sequence of materials.

B. Carefully handle all materials and store in original containers at not less than seventy (70) degrees F. for at least forty-eight (48) hours before start of installation.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F. or more than 95 deg F., in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.

2. During installation.

3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F. or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

1.8 WARRANTY

A. Provide manufacturers 5-year limited warranty.

PART 2 - PRODUCTS

2.2 TILE

A. See finish schedule.

2.3 BASE

A. Provide four (4) inches high, 1/8" thick, continuous vinyl, top set cove base with preformed internal and external corner pieces. For areas to receive carpet, provide flat base, no cove. Base shall conform to ASTM F 1861, Type TV, Group 1.

1. Color: Refer to Drawings.

2. Basis of Design: Johnsonite Tarkett; Vinyl Wall Base

3. Other Acceptable Manufacturers:

a. Burke Mercer
b. Marley Flexco
c. Armstrong

2.1 STAIR TREADS, RISERS AND NOSINGS

A. See finish schedule.

2.2 ACCESSORIES

A. Adhesives: Waterproof, stabilized type, as recommended by the tile manufacturer for the type of service indicated based on a RH of 90%.

B. Concrete Slab Primer: Non-staining type recommended by the tile manufacturer.

C. Leveling Compound: Novoplan 2 made by Mapei, Ardex K-15 or approved equal.

D. Edging Strips: 1/8" thick, homogeneous vinyl or rubber composition, tapered or bullnose edge, color as selected by the Architect from manufacturer's standards.

E. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

F. Finish

1. Cleaner shall be equal to "Super Shine All" made by Hillyard Chemical Co., or approved equal.

2. Wax shall be equal to "Super Hil-Brite" made by Hillyard Chemical Co., or approved equal.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where resilient tile flooring is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 CONDITION OF SURFACES

A. Allowable Variations in Substrate Levels (Floors): ± 1/8" in 10'-0" distance and 1/4" total maximum variation from levels shown.

B. Grind or fill concrete substrates as required to comply with allowable variation.

3.3 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture- vapor-emission rate of 3 lb. of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum **75** percent relative humidity level.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.4 INSTALLATION

A. Install tile only after all finishing operations, including painting, have been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by tile manufacturer.

B. Place tile units with adhesive cement in strict compliance with the manufacturer's recommendations. Butt tile units tightly to vertical surfaces, thresholds, nosings and edgings. Scribe around obstructions and to produce neat joints, laid tight, even and in straight, parallel lines. Extend tile units into toe spaces, door reveals, and into closet and similar openings.

C. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on the finish tile as marked in the subfloor. Use chalk or other non-permanent marking devices.

D. Lay tile from center marks established with principal walls, discounting minor off-sets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.

E. Match tiles for color and pattern by using tile from cartons in the same sequence as manufactured and packaged. Cut tile neatly to and around all fixtures. Broken, cracked, chipped or deformed tile is not acceptable.

F. Tightly cement tile to sub-base without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks through tile, or other surface imperfections.

G. Lay tile with grain in all tile running in the same direction.

H. Place resilient edge strips tightly butted to tile and secure with adhesive. Provide edging strips at all unprotected edges of tile, unless otherwise shown.

I. Bases: In all spaces where base is indicated, install bases tight to walls, partitions, columns, built-in cabinets, etc., without gaps at top or bulges at bottom, with tight joints and flush edges, with molded corner pieces at internal and external corners. Provide end stops adjacent to flush type door frames and where base does not terminate against an adjacent surface. Keep base in full contact with walls until adhesive sets.

J. Stair Treads

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.

2. Tightly adhere to substrates throughout length of each piece.

3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

3.5 CLEANING AND PROTECTION

A. Remove any excess adhesive or other surface blemishes from tile, using neutral type cleaners as recommended by the tile manufacturer. Protect installed flooring from damage by use of heavy Kraft paper or other covering.

B. Finishing: After completion of the project and just prior to the final inspection of the work, thoroughly clean tile floors and accessories. Apply two (2) coats of wax and buff using materials as specified herein.

END OF SECTION

SECTION 096723

RESINOUS FLOORING FOR RESTROOMS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the resinous flooring and base as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Resinous flooring and base - Epoxy type.

1.3 RELATED SECTIONS

A. Concrete - Section 033000.

B. Floor drains - Division 22.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract instructions and general recommendations for the resinous flooring specified herein.

B. Samples for initial selection purposes in form of manufacturer's color charts showing full range of colors and finishes available.

1. Submit three (3) 2-1/2" x 4" samples of each material specified herein with color from color chart selection designated by the Architect.

C. Material certificates signed by manufacturer certifying that the composition flooring complies with requirements specified herein.

D. Maintenance written instructions for recommended maintenance practices.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer or applicator who has specialized in installing flooring types similar to that required for this Project and who is acceptable to manufacturer of primary materials.

B. Single-Source Responsibility: Obtain resinous flooring materials, including primers, resins, hardening agents, and finish or sealing coats, from a single manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels containing brand name and directions for storage and mixing with other components.

B. Store materials to comply with manufacturer's directions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Comply with resinous flooring manufacturer's directions for maintenance of ambient and substrate temperature, moisture, humidity, ventilation, and other conditions required to execute and protect Work.

1.8 WARRANTY

A. Provide manufacturer's warranty with flashing endorsement, signed by Applicator and authorized representative of manufacturer, and warranting flooring materials against failures resulting from normal exposure for a period of three (3) years.

PART 2 PRODUCTS

2.1 RESINOUS FLOORING AND BASE - EPOXY

A. Provide a nominal 3/16" thick system consisting of a penetrating two-component epoxy primer, three-component mortar consisting of epoxy resin, curing agent and finely graded silica aggregate, three-component, epoxy undercoat, brightly colored, quartz silica aggregate broadcast and two coats of a high performance, two-component, clear epoxy sealer.

1. Texture: Medium.

2. Color: Refer to Drawings.

3. Basis of Design: Stonhard, Inc.; Stonshield HRI

4. Other Acceptable Manufacturers:

a. Sika USA
b. Dex-O-Tex
c. Sherwin Williams (General Polymers)

2.2 SUPPLEMENTAL MATERIALS

A. Flashing, Sheets, Cant Strips and Accessories: Types as recommended by flooring materials manufacturer, supplied for locations indicated and for locations recommended by manufacturer.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where resinous flooring is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Architect.

3.2 PREPARATION

A. Substrate: Perform preparation and cleaning procedures according to flooring manufacturer's instructions for particular substrate conditions involved, and as specified. Provide clean, dry, and neutral substrate for flooring application.

B. Concrete Surfaces: Shot-blast, acid etch or power scarify as required to obtain optimum bond of flooring to concrete. Remove sufficient material to provide a sound surface free of laitance, glaze, efflorescence, and any bond-inhibiting curing compounds or form release agents. Remove grease, oil, and other penetrating contaminants. Repair damaged and deteriorated concrete to acceptable condition. Leave surface free of dust, dirt, laitance, and efflorescence.

C. Materials: Prepare materials according to flooring system manufacturer's instructions.

D. Starting of work implies acceptance of slab.

3.3 APPLICATION

A. General: Apply each component of resinous flooring system according to manufacturer's directions to produce a uniform monolithic flooring surface at the nominal thickness required.

1. Start installation of flooring only in presence of manufacturer's technical representative who must approve (in writing to the Architect) condition of the prepared floor slab.

B. Flooring system shall include the following minimum applications:

1. Detail all cracks and control joints according to manufacturer’s requirements.

2. Bonding coat per manufacturer’s requirements.

3. Membrane coat per manufacturer’s requirements.

4. Reinforcement fabric as required by manufacturer.

5. Smoothing coat for reinforced membrane systems as required by manufacturer.

6. Wear course as required by manufacturer.

7. Topcoat/Sealer: One or two topcoats as required by manufacturer.

C. Cove Base: Apply cove base mix to wall surfaces at locations shown to form cove base height of 8" unless otherwise indicated. Follow manufacturer's printed instructions anddetails including taping, mixing, priming, troweling, sanding, and top-coating of cove base.

3.4 TESTING

A. Test installation for leaks immediately after nominal cure of the completed flooring. Flood each area to a depth of one inch for 24 hours. Repair all leaks and repeat test until no leakage is observable.

3.5 CURING, PROTECTION AND CLEANING

A. Cure resinous flooring materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.

END OF SECTION

SECTION 096813

CARPET TILE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor materials, equipment and services necessary to complete the carpet tile as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Carpet tile.

2. Entry mat carpet tile and frame.

3. Adhesive.

1.3 RELATED SECTIONS

A. Concrete sub-floor – Section 033000.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Firm with not less than five (5) years of experience in installation of commercial carpeting of type, quantity and installation methods similar to work of this Section.

B. General Terminology/ Information Standard: Refer to current edition of "Carpet Specifier's Handbook" by The Carpet and Rug Institute; for definitions of terminology not otherwise defined herein, and for general recommendations and information.

C. Carpet used on Project must be from same dye lot for each carpet type.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's complete technical product data for each type of carpet, cushion and accessory item required.

B. Samples: Submit full size samples of carpet tile and six (6) inches long samples of each type exposed edge stripping.

C. Certification: Submit manufacturer's certification stating that carpet materials furnished comply with specified requirements.

1. Include listing of mill register numbers for carpet furnished.

2. Include supporting certified laboratory test data indicating that carpet meets or exceeds specified test requirements.

3.

D. Maintenance Data: Submit manufacturer's printed maintenance recommendations, including methods and frequency recommended for maintaining carpet in optimum conditions under anticipated traffic and use conditions.

1.6 EXTRA STOCK

A. Produce and deliver to project at least five (5) percent overrun on calculated yardage. Provide required overrun exclusive of carpet needed for proper installation, waste and usable scraps.

1.7 PRODUCT DELIVERY AND STORAGE

A. Deliver carpeting materials in original mill protective wrapping with mill register numbers and tags attached. Store inside, in well ventilated area, protected from weather, moisture and soiling.

1.8 WARRANTY

A. Provide special project warranty, signed by Contractor and Manufacturer (Carpet Mill), agreeing to repair or replace defective materials and workmanship of carpeting work during two (2) year warranty period following substantial completion. Attach copies of product warranty.

PART 2 PRODUCTS

2.1 CARPET TILE

A. See finish schedule.

2.2 ACCESSORIES

A. Adhesive for Carpet Tile: Provide release type adhesive as recommended by the carpet tile manufacturer for use with carpet tile specified. Provide adhesive which complies with flame spread rating required for the carpet installation.

B. Miscellaneous Materials: Provide the types of adhesives and tape, and other accessory items recommended by the carpet manufacturer and Installer for the conditions of installation and use.

C. Leveling Compound: Latex/Portland cement flash patching and leveling compound equal to No. DSP-520 made by H.B. Fuller or No. 226 with 3701 admixture made by Laticrete or equal made by Mapei, or approved equal.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where carpet tile is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 PRE-INSTALLATION REQUIREMENTS

A. Floor shall be clean and free of cracks and protrusions. Any gaps or cracks more than 1/16" wide to be filled in with latex leveling compound. Protrusions must be sanded down smooth, the floor cleanly swept and vacuumed if necessary to remove all dust and grit.

B. Floor temperature shall be 65 deg., at least 24 hrs. prior to installation; and 48 hrs. after carpet is installed.

C. Conduct a moisture test. The presence of moisture in the concrete floor will interfere with the curing and subsequent performance of the adhesive. Conduct the test as follows:

1. Drive a concrete nail a half inch into the floor. Then remove the nail.

2. Place a small amount of anhydrous calcium chloride or calcium sulphate crystals over the hole.

3. Cover the crystals and the hole with a piece of flat glass and seal the edges with waterproof tape or putty. Since concrete pourings vary, repeat the test every 1500 sq. ft.

4. Leave in place 72 hrs. Any color change in the crystals indicates the presence of moisture. Do not apply carpet until slab is free of moisture and meets with approval of carpet adhesive manufacturer.

D. Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet during remainder of construction period.

3.3 INSTALLATION

A. General

1. Comply with manufacturer’s instructions and recommendations. Maintain direction of pattern and texture, including lay of pile.

2. Adhere all tiles with a full spread of adhesive. Dry-fit cut tiles and apply adhesive to tile back after tile has been cut.

3. Tiles shall be installed in a monolithic corner to corner manner following arrows printed on back of each tile indicating pile direction. Tiles shall be installed to achieve patterns as directed by the Architect.

4. Vinyl reducer strips shall be used along any necessary open edges so as to maintain the fixed perimeter.

3.4 CLEANING UP

A. Upon completion of the carpeting installation in each area, visually inspect all carpet installed in that area and immediately remove all dirt, soil, and foreign substance from the exposed face; inspect all adjacent surfaces and remove all marks and stains caused by the carpet installation: remove all packaging materials, carpet scraps, and other debris from the carpet installation to the area of the job site set aside for its storage.

3.5 PROTECTION

A. In all areas, provide a temporary non-staining paper pathway in the direction of traffic.

END OF SECTION

SECTION 097200

WALLCOVERING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the wallcovering as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Gypsum Drywall - Section 092900.

B. Painting and Finishing - Section 099000.

1.4 QUALITY ASSURANCE

A. Qualifications of Installers: For actual cutting and installation of wallcovering, use only thoroughly trained and experienced installers completely familiar with the installation recommendations of the manufacturer of the wallcovering used and completely familiar with the requirements of this work.

B. Manufacturer's Recommendations: The installation recommendations of the manufacturer of the wallcovering used, when approved by the Architect, shall be the basis for acceptance or rejection of actual installation methods used in this work.

C. Test Panels: Install three (3) test panels of full usable width, including one corner, in areas designated by the Architect. Replace test panels which are not acceptable to the Architect until satisfactory installation is achieved.

1.5 SUBMITTALS

A. Samples: Before any wallcovering is delivered to the job site, submit to the Architect samples of the full range of colors and patterns of wallcovering available from the selected manufacturer in the quality and type specified. Samples shall be a min. 36" x 36" in size.

B. Manufacturer’s Recommendations: Accompanying the samples, submit to the Architect copies of the manufacturer's current installation recommendations for the material proposed to be furnished and installed under this Section.

C. A Certificate of Compliance shall be furnished indicating conformance to the specification requirements. This requirement may be waived if fabric and adhesive packages and containers delivered to the job carry labels indicating weight of materials and fire hazard classification.

1.6 MAINTENANCE INSTRUCTION

A. Furnish the Owner with a copy of the fabric manufacturer's maintenance instructions. These instructions shall contain recommended cleaning materials, application methods, and precautions to be followed in the use of cleaning materials which may be detrimental to the surface if improperly applied.

1.7 EXTRA WALLCOVERING

A. Deliver to the Owner sizable remnants for future patching purposes. Also furnish to the Owner one (1) complete roll of each wallcovering used.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver and store all wallcovering in undamaged condition as packaged by the manufacturer, with manufacturer's seal and labels intact. Exercise care to prevent damage during delivery, handling and storage. Store all materials flat in a clean, dry area with maintained temperature above 40 deg. F.

1.9 ENVIRONMENTAL CONDITIONS

A. Wallcovering should be installed only when normal temperature and humidity conditions approximate the same conditions that will exist when the building is occupied.

B. Areas to receive wallcovering shall be a constant temperature of 70 deg. F. measured at base elevation and shall be maintained for 72 hrs. before, during and 48 hrs. after the application.

C. Remove wallcovering from its packaging and allow to acclimatize to the area of installation 24 hrs.

PART 2 PRODUCTS

2.1 MATERIALS

A. Refer to Finish Schedule for description of wallcovering material.

B. Vinyl Wallcovering: Provide vinyl wallcovering conforming to ASTM F793, Category V, Type II, weight not less than 20 oz. per sq. yd., with minimum coating (less fabric) 12 oz. per sq. yd.

1. Basis of Design: Surface Materials; Levels

2. Color: Refer to Drawings.

C. Material shall comply with the following fire hazard classification as determined by ASTM E84:

1. Flame spread not more than 25.

2. Fuel contributed not more than 15.

3. Smoke developed not more than 25.

D. Provide Class 2 mildew-resistant backing and comply with the requirements of ASTM D1308 for determining stain resistance.

2.2 ACCESSORIES

A. Adhesive: "Sure Grip Plus Mold and Mildew-Proof Commercial Wall Covering Adhesive" made by The Zinsser Co. Inc. or as recommended by manufacturer.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where wallcovering is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 PREPARATION

A. Remove wallcovering material from its packaging and allow to acclimatize to the area of installation 24 hrs. before application.

B. Remove switch plates, wall plates, and surface-mounted fixtures, where wallcovering is to be applied.

C. Prime and seal substrates in accordance with wallcovering manufacturer's recommendations for the type of substrate materials to be covered.

D. Surfaces to receive wallcovering shall be free from grit, loose particles and surface irregularities and shall meet the minimum requirements established by the wallcovering manufacturer. Fill all cracks and holes in gypsum board with patching compound and sandpaper smooth.

E. Provide tarpaulins, drop cloths and other suitable covers to protect adjacent and underlying surfaces which are likely to be stained, spotted or otherwise marked by wallpaper paste and application operations.

3.3 INSTALLATION

A. Place wallcovering panels consecutively in the order they are cut from rolls, including filling of spaces above or below openings. Hang by reversing alternate strips, except on match patterns.

B. Apply adhesive to back of wallcovering following adhesive manufacturer's instructions, using roller or paste brush. Install seams vertically and plumb, and at least 6" away from any corner; horizontal seams will not be permitted. Place wallcovering continuously over internal and external corners, going 12" beyond outside corners and 6" at inside corners. Overlap seams and double cut to ensure tight closure. Roll, brush or use a broad knife to remove air bubbles, wrinkles, blisters and other defects. Cut wallcovering evenly to the edges of the outlet box or support.

C. Trim selvages as required to ensure color uniformity and pattern match at seams.

D. Remove excess adhesive along finished seams using warm water and a clean sponge; wipe dry.

E. Install wallcovering with an intimate substrate bond, smooth, clean, without wrinkles, gaps and overlaps.

F. Replace removed plates and fixtures to verify cut edges of wallcovering are completely concealed.

G. Verify that pattern and color are as specified. If pattern is not random, examine for repeat in design.

H. Hang smooth, non-match patterns by pasting strips on the wall, overlapping the edges, and "Double-Cutting" through both thicknesses. Use a 0.04" or 0.06" zinc or aluminum strip between wall and strip when cutting, to avoid gouging the wall.

I. Use stiff-bristled brush or flexible board knife to eliminate air pockets and to secure the wallcovering to the wall surface.

J. Fill spaces above and below doors and similar areas in sequence from the roll, not later than when all full-length pieces have been installed.

K. Examine each seam carefully when completed. Trim additional selvage where required to achieve a color and pattern match at seams.

L. Apply wallcovering before the installation of plumbing fixtures, casings, bases and cabinets.

3.4 PROTECTION

A. Protect finished work installed by other trades prior to work under this Section. Replace any work damaged by workmen of this trade without cost to the Owner.

3.5 CLEAN-UP

A. Any hardware, accessories, plates, etc., which are removed during wallcovering installation shall be replaced level and square.

B. All debris resulting from work covered in this Section shall be removed from the building on a daily basis.

END OF SECTION

SECTION 097800

REINFORCED PLASTIC PANELING SYSTEM

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the reinforced plastic paneling system as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Reinforced plastic paneling system.

2. Moldings.

1.3 RELATED SECTIONS

A. Gypsum drywall - Section 092900.

1.4 QUALITY ASSURANCE

A. Installer: A firm which has at least three years' experience in work of the type required by this section and which is acceptable to the manufacturers of the primary materials.

B. Source: Provide plastic panels which are the products of one manufacturer. Provide secondary materials, moldings and accessories which are acceptable to the panel manufacturer.

C. In-Place Samples: Before beginning primary work of this section, provide typical in-place samples of each item and type of work at locations acceptable to the Architect and obtain the Architect's acceptance of visual qualities.

1. Size of Sample: Not less than 32 square feet.

2. Intent of Sample: The intent of the in-place sample is to obtain approval of a typical installation as early as possible so that problems, if any, can be corrected before the problem is repeated.

3. Sample Disposition: Acceptable in-place samples may be incorporated into the finished work. Protect and maintain acceptable in-place samples throughout the work of this section to serve as criteria for acceptance of the work

D. Burning Characteristics: Provide materials whose surface burning characteristics, when tested in compliance with ASTM E 84 are classified as Class A or Class 1.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material used. Provide certifications stating that materials comply with requirements.

B. Initial Selection Samples: Submit minimum 3" x 3" samples showing complete range of colors, textures, and finishes available for each material used.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

PART 2 PRODUCTS

2.1 FIBERGLASS PLASTIC PANEL SYSTEM

A. Products: Provide one of the following products:

1. "Fiber-Lite Liner Panels," Nudo Products, Inc.

2. "Fire-X Glasbord," Crane Composites, Inc.

3. "Induro FRP," Marlite.

4. "Glasliner FRP Wall Panels," Glasteel Fiberglass Reinforced Panels, Division of Stabilit America, Inc.

B. Panel Characteristics: Provide one of the specified products having the following characteristics:

1. Thickness: Not less than 0.09" thick.

2. Texture: Manufacturer's standard pebble texture.

3. Panel Size: Provide largest sizes available to minimize joints and seams.

4. Colors: Provide panels and matching moldings and rivets as selected by the Architect from the manufacturer's standard colors.

C. Moldings: Provide vinyl moldings as recommended and approved by the panel manufacturer.

D. Panel Fasteners: Provide nylon rivets recommended by manufacturer for installing reinforced plastic panels to gypsum drywall and metal stud substrates. Do not use any metal in rivets.

E. Accessories: Provide all necessary sealants, components and accessories as recommended by panel manufacturer for a complete, sanitary, easy-to-clean installation. Use only sanitary, mold inhibiting USDA approved silicone sealant.

PART 3 EXECUTION

3.1 INSTALLATION

A. Pre-Installation Examination Required: The Installer shall examine previous work, related work, and conditions under which this work is to be performed and notify Contractor in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Installer accepts substrates, previous work, and conditions.

B. Manufacturer's Instructions: Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.

C. Installation: Mechanically attach panels to substrates indicated using non-metallic rivets at spacing recommended by panel manufacturer. Provide expansion clearance at all panel edges as required by manufacturer, but make sure moldings cover panel edges. Gaps are not permitted.

1. Trim and Molding: Provide moldings at all edges, joints, seams and corners. Provide moldings having the easiest to clean shapes and profiles available.

2. Sealing: Seal all edges, joints, seams, and corners as the work progresses.

D. Tolerances: The following allowable installed tolerances are allowable variations from locations and dimensions indicated by the Contract Documents and shall not be added to allowable tolerances indicated for other work.

1. Allowable Variation from True Plumb, Level, and Line: ± 1/8" in 20'-0".

2. Allowable Variation from True Plane: 1/8" in 10'-0".

3.2 CLEANING AND PROTECTION

A. Cleaning: Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer of material or product being cleaned. Remove and replace work that cannot be successfully cleaned or repaired.

B. Protection: Provide temporary protection to ensure work is without damage or deterioration at time of final acceptance. Remove protections and re-clean as necessary immediately before final acceptance.

END OF SECTION

SECTION 098413

ACOUSTIC WALL PANELS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the acoustic wall panels as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. 2" thick acoustical absorption panels wrapped in selected fabric.

1.3 RELATED SECTIONS

A. Carpentry - Section 062000.

B. Gypsum wallboard - Section 092900.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualification: At least 5 years' experience fabricating and installing comparable work, employing skilled mechanics under competent supervision for all phases of the Work.

1.5 SUBMITTALS

A. Shop Drawings/Product Data

1. Base drawings on field measurements.

2. Show dimensioned wall elevations with seam and joint locations, cutout sizes and locations, anchor locations, relation to adjacent work; large scale joint and mounting details; materials type, weight/thickness, design, color; and other data necessary to fabricate and install work and coordinate work with affected trades.

B. Samples: Two 12" x 12" (minimum) panels in selected finish, showing seam, edge and cutout conditions.

C. Certification

1. Acoustical Performance: Certified reports of acoustical performance tests conducted and/or witnessed by a recognized, independent, testing agency. Tests shall have been done by specified methods or recognized equivalent. Sound absorption tests shall be not more than three years old. Reports on earlier tests

are acceptable if it can be established to the Architect's satisfaction, that they are valid indications of compliance with Project requirements.

2. Fire Hazard: Evidence of compliance with regulatory agency and specifications requirements.

D. Cleaning and Maintenance Instructions: Recommendations for Owner maintenance and cleaning per Section 017300 requirements. Identify cleaning/spotting products generically or by trade name.

E. Manufacturer Qualifications: List comparable installations with 3-year (minimum) service histories. Describe installations and give Owner/building manager names and addresses.

1.6 REFERENCES

A. ASTM C 423 Test for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. ASTM E 84 Test for Surface Burning Characteristics of Building Materials.

1.7 DELIVERY, STORAGE AND HANDLING

A. Allow materials to become acclimated to Project conditions before installation, if necessary to prevent sag and distortion during service life.

1.8 PROJECT CONDITIONS

A. Environmental Conditions

1. Work areas shall be at or near ambient occupancy temperature and relative humidity.

2. Painting, dust-raising activities, and work that introduces dampness shall be completed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide products manufactured by one of the following:

1. Armstrong World Industries.

2. DFB Sales Inc.

3. Fabritrak Systems Inc.

4. StretchWall Products Inc.

2.2 GENERAL

A. Fabricate panels to sizes and configurations indicated; attach facing materials to cores to produce installed panels with visible surfaces fully covered and free from waves in fabric weave, wrinkles, sages, blisters, seams, adhesive or other foreign matter.

1. Fabricate back mounted panels in factory to exact sizes required to fit wall surfaces based on field measurements of completed substrates indicated to receive acoustical wall panels.

2. Where radius corners are indicated, attach facing material so there are no seams or gathering of material.

B. Dimensional Tolerances of Finished Units: Overall height and width of panels - plus or minus 1/16".

C. Sound Absorption Performance: Provide acoustical wall panels with minimum noise reduction coefficients (NRC) indicated, as determined by testing per ASTM C 423 for mounting type specified under individual product requirements.

D. Colors, Textures, and Patterns: Where manufacturer's standard material is indicated, provide acoustical wall panels faced with manufacturer's material complying with the following requirements:

1. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.

2.3 BACK MOUNTED ACOUSTICAL WALL PANELS

A. Back Mounted, Edge Reinforced Acoustical Wall Panels: Manufacturer's standard panel construction consisting of facing material laminated to front, edges, and back border of molded glass fiber board core; with edges chemically hardened to reinforce panel perimeter against warpage and damaged; and complying with the following requirements:

1. Core Density: 6 - 7 lb./cu. ft.

2. Thickness and NRC: Nominal overall panel thickness of 2" and NRC of not less than 0.95 for Type A (ABPMA No. 4) mounting.

3. Facing Material: Manufacturer's standard abuse resistant woven polyester fabric over glass fiber scrim.

4. Panel Size: As indicated.

5. Edge Detail: Square.

2.4 ACCESSORIES

A. Back Mounting Accessories: Manufacturer's standard or recommended accessories for securely mounting panels of type and size indicated to substrates provided, and complying with the following requirements:

1. Mechanically Mounted Edge Reinforced Panels: Metal panel clip and base support bracket system consisting of 2 part panel clips, with one part of each clip mechanically attached to back of panel and the other part to wall substrate, designed to support panels laterally; and base support brackets designed to support full weight of panels; with both designed to allow panel removal.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where acoustic wall panels are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. General

1. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, scribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's printed instructions for installation of panels using type of mounting accessories indicated or, if none indicated, as recommended by manufacturer.

2. Construction Tolerances

a. Variation from Plumb and Level: +/- 1/16".
b. Variation of Joints from Hairline: Not more than 1/16".

B. Anchoring to Drywall: Anchor clips to unreinforced gypsum board with toggle or Molly anchors. Anchor clips to metal drywall framing with tapping sheet metal screws.

C. Panels shall be pressed against wall and slid down engaging "Z" clips into wall brackets.

D. Remove and replace panels that are damaged and are unacceptable to Architect.

3.3 ADJUSTING AND CLEANING

A. Correct non-complying and damaged/defective Work. Replace work that cannot be satisfactorily repaired.

B. Restretch and reinstall sagging and distorted fabric and correct other defects that occurred during normal service.

C. Carefully and thoroughly clean completed work by vacuuming and/or other means. Remove soil, stains, loose threads.

D. Protect work from soiling and other damage.

END OF SECTION

SECTION 099000

PAINTING AND FINISHING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Prime painting unprimed surfaces to be painted under this Section.
2. Painting all items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
3. Painting all ferrous metal (except stainless steel) exposed to view.
4. Painting all galvanized ferrous metals exposed to view.
5. Painting interior concrete block exposed to view.
6. Painting gypsum drywall exposed to view.
7. Painting plaster surfaces.
8. Painting concrete floor.
9. Sealing of concrete floor.
10. Painting of wood exposed to view, except items which are specified to be painted or finished under other Sections of these specifications. Back painting of all wood in contact with concrete, masonry or other moisture areas.
11. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
12. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers, lighting fixtures, and the like, which are exposed to view through these items.
13. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
14. Painting of any surface not specifically mentioned to be painted herein or on drawings, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, shall be included as though specified.

1.3 RELATED SECTIONS

A. Shop priming is required on some, but not all of the items scheduled to be field painted. Refer to other Sections of work for complete description.

B. Shop Coat on Machinery and Equipment: Refer to the Sections under which various items of manufactured equipment with factory applied shop prime coats are furnished, including, but not necessarily limited to, the following Sections. All items of equipment furnished with prime coat finish shall be finish painted under this Section.

1. Plumbing - Division 22.

2. Heating, ventilation and air conditioning - Division 23.

C. Color Coding of Mechanical Piping and Electrical Conduits - Divisions 22 and 26.

1. This Color Coding consists of an adhesive tape system and is in addition to painting of piping and conduits under this Section, as specified above.

1.4 MATERIALS AND EQUIPMENT NOT TO BE PAINTED

A. Items of equipment furnished with complete factory finish, except for items specified to be given a finish coat under this Section.

B. Factory-finished toilet partitions.

C. Factory-finished acoustical tile.

D. Non-ferrous metals, except for items specified and/or indicated to be painted.

E. Finished hardware, excepting hardware that is factory primed.

F. Surfaces not to be painted shall be left completely free of droppings and accidentally applied materials resulting from the work of this Section.

1.5 QUALITY ASSURANCE

A. Job Mock-Up

1. In addition to the samples specified herein to be submitted for approval, apply in the field, at their final location, each type and color of approved paint materials, applied 10 feet wide, floor to ceiling of wall surfaces, before proceeding with the remainder of the work, for approval by the Architect. Paint mock-ups to include door and frame assembly.

2. These applications when approved will establish the quality and workmanship for the work of this Section.

3. Repaint individual areas which are not approved, as determined by the Architect, until approval is received. Assume at least two paint mock-ups of each color and gloss for approval.

B. Qualification of Painters: Use only qualified painters for the mixing and application of paint on exposed surfaces.

C. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Architect in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

D. All paints must conform to the Volatile Organic Compounds (VOC) standards of prevailing codes and ordinances.

1.6 SUBMITTALS

A. Materials List

1. Before any paint materials are delivered to the job site, submit to the Architect a complete list of all materials proposed to be furnished and installed under this portion of the work.

2. This shall in no way be construed as permitting substitution of materials for those specified or accepted for this work by the Architect.

B. Samples

1. Accompanying the materials list, submit to the Architect copies of the full range of colors available in each of the proposed products.

2. Upon direction of the Architect, prepare and deliver to the Architect two (2) identical sets of Samples of each of the selected colors and glosses painted onto 8-1/2" x 11" x 1/4" thick material; whenever possible, the material for Samples shall be the same material as that on which the coating will be applied in the work.

C. Manufacturer's Recommendations: In each case where material proposed is not the material specified or specifically described as an acceptable alternate in this Section of these specifications, submit for the Architect's review the current recommended method of application published by the manufacturer of the proposed material.

D. Close out Submittal

1. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or plant manufacturer/supplier shall furnish a coating maintenance manual such as Sherwin Williams “Custodian Project Color and Product Information” report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, MSDS, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.7 PRODUCT HANDLING

A. Deliver all paint materials to the job site in their original unopened containers with all labels intact and legible at time of use.

B. Protection

1. Store only the approved materials at the job site, and store only in a suitable and designated area restricted to the storage of paint materials and related equipment.

2. Use all means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.

3. Use all means necessary to protect paint materials before, during and after application and to protect the installed work and materials of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.8 EXTRA STOCK

A. Upon completion of this portion of the Work, deliver to the Owner an extra stock of paint equaling approximately ten (10) percent of each color and gloss used and each coating material used, with all such extra stock tightly sealed in clearly labeled containers.

1.9 JOB CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F. and 90 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F. and 95 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds eighty-five (85) percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.

D. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

PART 2 PRODUCTS

2.1 PAINT MANUFACTURERS

A. Except as otherwise noted, provide the painting products listed for all required painting made by one of the manufacturers listed in the paint schedule (Section 2.4). These companies are Benjamin Moore, PPG Paints (PPG), and Sherwin Williams (S-W). Comply with number of coats and required minimum mil thicknesses as specified herein.

2.2 MATERIALS

A. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer and use only to recommended limits.

B. Colors and Glosses: All colors and glosses shall be as selected by the Architect. Certain colors will require paint manufacturer to prepare special factory mixes to match colors selected by the Architect. Color schedule (with gloss) shall be furnished by the Architect.

C. Coloring Pigment: Products of or furnished by the manufacturer of the paint or enamel approved for the work.

D. Linseed Oil: Raw or boiled, as required, of approved manufacture, per ASTM D 234 and D 260, respectively.

E. Turpentine: Pure distilled gum spirits of turpentine, per ASTM D 13.

F. Shellac: Pure gum shellac (white or orange) cut in pure denatured alcohol using not less than four (4) lbs. of gum per gallon of alcohol.

G. Driers, Putty, Spackling Compound, Patching Plaster, etc.: Best quality, of approved manufacture.

H. Heat Resistant Paint: Where required, use heat resistant paint when applying paint to heating lines and equipment.

2.3 GENERAL STANDARDS

A. The various surfaces shall be painted or finished as specified below in Article 2.4. However, the Architect reserves the right to change the finishes within the range of flat, semi-gloss or gloss, without additional cost to the Owner.

B. All paints, varnishes, enamels, lacquers, stains and similar materials must be delivered in the original containers with the seals unbroken and label intact and with the manufacturer's instructions printed thereon.

C. All painting materials shall bear identifying labels on the containers with the manufacturer's instructions printed thereon.

D. Paint shall not be badly settled, caked or thickened in the container, shall be readily dispersed with a paddle to a smooth consistency and shall have excellent application properties.

E. Paint shall arrive on the job color-mixed except for tinting of under-coats and possible thinning.

F. All thinning and tinting materials shall be as recommended by the manufacturer for the particular material thinned or tinted.

G. It shall be the responsibility of the Contractor to see that all mixed colors match the color selection made by the Architect prior to application of the coating.

2.4 SCHEDULE OF FINISHES

A. High Performance Coating on Exterior Galvanized Ferrous Metals

First Coat: "PittGuard Rapid Coat Epoxy 95-245 Series by PPG, "Series 27WB Typoxy" by Tnemec; "Epoxy Mastic Coating V160" by Benjamin Moore Corotech or "Recoatable Epoxy Primer 867-45" by Sherwin Williams.

Second Coat: "Pitthane Ultra 95-812 (Gloss)" or "High Build 95-8800 (Semi-Gloss)" by PPG; "Series 1080 (gloss) Endura-Shield WB" or "Series 1081 (semi-gloss) Endura-Shield WB" by Tnemec; "Acrylic Aliphatic Urethane V500 (Gloss)" or "V510 (Semi-Gloss)" by Benjamin Moore Corotech or "Hi-Solids Urethane B65-300/350" by Sherwin Williams.

B. High Performance Coating on Exterior Non-Galvanized Ferrous Metals

Prime Coat: "Amercoat 68HS Epoxy Zinc-Rich Primer" by PPG; "Series 94-H_2O Hydro-Zinc" by Tnemec; "Organic Zinc Rich Primer V170" by Benjamin Moore Corotech or "Zinc Clad II Plus Inorganic Zinc Rich Coating B69V212" by Sherwin Williams.
Second Coat: "Pitt Guard Rapid Coat Epoxy 95-245" by PPG; "Series 27WB Typoxy" by Tnemec; "Epoxy Mastic Coating V160" by Benjamin Moore Corotech or "Macropoxy 646 Fast Cure Epoxy B58-600" by Sherwin Williams.
Third Coat: "Pitthane Ultra 95-812 (Gloss)" or "High Build 95-8800 (Semi-Gloss)" by PPG; "Series 1070V (gloss) Fluoronar" or "Series 1071V (semi-gloss) Fluoronar" by Tnemec; "Acrylic Aliphatic Urethane V500 (Gloss)" or "V510 (Semi-Gloss)" by Benjamin Moore Corotech or "Hi- Solids Polyurethane B65-300/350" by Sherwin Williams.

C. Interior Ferrous Metal

Satin Finish/Latex
Primer: Benj. Moore Ultra Spec HP Acrylic Metal Primer (HP04)
PPG Pitt Tech Plus DTM Acrylic Primer 4020
S-W Pro-Industrial Pro-Cryl Universal Primer B66-3100 Series
First Coat: Benj. Moore Corotech Pre-Catalyzed WB Epoxy Eggshell (V342)
PPG Pitt Glaze WB1 Pre-Catalyzed Eggshell Epoxy 16-310
S-W Pro Industrial Acrylic Eg-Shel, B66-660 Series
Second Coat: Benj. Moore Corotech Pre-Catalyzed WB Epoxy Eggshell (V342)
PPG Pitt Glaze WB1 Pre-Catalyzed Eggshell Epoxy 16-310
S-W Pro Industrial Acrylic Eg-Shel, B66-660 Series
a. Total DFT not less than: 3.9 mils

Semi-Gloss Finish/Latex
Primer: Benj. Moore Ultra Spec-HP Acrylic Metal Primer (HP04)
PPG Devflex 4020 PF DTM Primer/Flat Finish
S-W Pro-Industrial Pro-Cryl Universal Primer B66-3100 Series
First Coat: Benj. Moore Corotech Pre-Catalyzed WB Epoxy Semi-Gloss (V341)
PPG Pitt Glaze WB1 Pre-Catalyzed Semi-Gloss Epoxy 16-510
S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series
Second Coat: Benj. Moore Corotech Pre-Catalyzed WB Epoxy Semi-Gloss (V341)
PPG Pitt Glaze WB1 Pre-Catalyzed Semi-Gloss Epoxy 16-510
S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series
a. Total DFT not less than: 4.0 mils

D. Interior Concrete Block

Flat Finish/Vinyl Acrylic Latex over Filler
Block Filler: Benj. Moore Ultra Spec Masonry Int./Ext. High Build Block Filler (571)
PPG Speedhide HI Fill Latex Block Filler 6-15XI
S-W Pro Industrial Heavy-Duty Block Filler, B42-150
First Coat: Benj. Moore Ultra Spec 500 Interior Flat Latex (N536)
PPG Speedhide Zero Interior Latex Flat 6-4110XI
S-W ProMar 200 Zero VOC Interior Latex Flat, B30-12600 Series
Second Coat: Benj. Moore Ultra Spec 500 Interior Flat Latex (N536)
PPG Speedhide Zero Interior Latex Flat 6-4110XI
S-W ProMar 200 Zero VOC Interior Latex Flat, B30-12600 Series

a. Total DFT not less than: 10.7 mils

Eggshell Finish/Vinyl Acrylic Latex Over Filler
Block Filler: Benj. Moore Ultra Spec Masonry Int./Ext. High Build Block Filler (571)
PPG Speedhide HI Fill Latex Block Filler 6-15XI
S-W Pro Industrial Heavy-Duty Block Filler, B42-150
First Coat: Benj. Moore Ultra Spec 500 Interior Latex Eggshell (N538)
PPG Speedhide Zero Interior Latex Eggshell 6-4310XI
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
Second Coat: Benj. Moore Ultra Spec 500 Interior Latex Eggshell (N538)
PPG Speedhide Zero Interior Latex Eggshell 6-4310XI
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
a. Total DFT not less than: 10.9 mils

Semi-Gloss Finish/Vinyl Acrylic Latex over Filler
Block Filler: Benj. Moore Ultra Spec Masonry Int./Ext. High Build Block Filler (571)
PPG Speedhide HI Fill Latex Block Filler 6-15XI
S-W Pro Industrial Heavy-Duty Block Filler, B42-150
First Coat: Benj. Moore Ultra Spec 500 Interior Latex Gloss (N540)
PPG Speedhide Zero Interior Semi-Gloss Latex, 6-4510XI Series
S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series
Second Coat: Benj. Moore Ultra Spec 500 Interior Latex Gloss (N540)
PPG Speedhide Zero Interior Semi-Gloss Latex, 6-4510XI Series
S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series
a. Total DFT not less than: 10.7 mils

E. Interior Drywall

Flat Finish/Vinyl Acrylic Latex
Primer: Benj. Moore Ultra Spec 500 Interior Latex Primer (N534)
PPG Speedhide Zero Interior Latex Primer 6-4900XI
S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
First Coat: Benj. Moore Ultra Spec 500 Latex Flat (N536)
PPG Speedhide Zero Interior Latex Flat 6-4110XI
S-W ProMar 200 Zero VOC Interior Latex Flat, B30-12600 Series
Second Coat: Benj. Moore Ultra Spec 500 Latex Flat (N536)
PPG Speedhide Zero Interior Latex Flat 6-4110XI
S-W ProMar 200 Zero VOC Interior Latex Flat, B30-12600 Series
a. Total DFT not less than: 3.6 mils

Eggshell Finish/ Scuff Resistant Latex
Primer: Benjamin Moore Ultra Spec 500 Interior Latex Primer (N534)
First Coat: Benjamin Moore Ultra Spec Scuff-X Latex Eggshell (485)
Second Coat: Benjamin Moore Ultra Spec Scuff-X Latex Eggshell (485)

Matte Finish/Scuff and Stain Resistant Acrylic Latex
Primer: PPG Pure Performance Interior Latex Primer 9-900
First Coat PPG UltraLast Interior Latex Paint + Primer Matte 13-210
Second Coat PPG UltraLast Interior Latex Paint + Primer Matte 13-210

Eggshell Finish/Scuff and Stain Resistant Acrylic Latex
Primer: PPG Pure Performance Interior Latex Primer 9-900
First Coat PPG UltraLast Interior Latex Paint + Primer Eggshell 13-310
Second Coat PPG UltraLast Interior Latex Paint + Primer Eggshell 13-310

Semi-Gloss Finish/Scuff and Stain Resistant Acrylic Latex
Primer: PPG Pure Performance Interior Latex Primer 9-900
First Coat PPG UltraLast Interior Latex Paint + Primer Semi-Gloss 13-510
Second Coat PPG UltraLast Interior Latex Paint + Primer Semi-Gloss 13-510

Eggshell Finish/Vinyl Acrylic Latex
Primer: Benj. Moore Ultra Spec 500 Interior Latex Primer (N534)
PPG Speedhide Zero Interior Latex Primer 6-4900XI
S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
First Coat: Benj. Moore Ultra Spec 500 Interior Latex Eggshell (N538)
PPG Speedhide Zero Interior Latex Eggshell 6-4310XI
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
Second Coat: Benj. Moore Ultra Spec 500 Interior Latex Eggshell (N538)
PPG Speedhide Zero Interior Latex Eggshell 6-4310XI
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
a. Total DFT not less than: 3.8 mils

F. Interior Painted Wood

Satin Finish/Latex
Primer: Benj. Moore Fresh Start Latex Primer (0023)
PPG Seal Grip Int./Ext. Acrylic Universal Primer/Sealer 17-921
S-W Multi-Purpose Latex Primer/Sealer B51 Series
First Coat: Benj. Moore Ultra Spec 500 Interior Latex Semi-Gloss (N539)
PPG Speedhide Zero Interior Latex Satin, 6-4410XI
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
Second Coat: Benj. Moore Ultra Spec 500 Interior Latex Semi-Gloss (N539)
PPG Speedhide Zero Interior Latex Satin, 6-4410XI
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
a. Total DFT not less than: 4.0 mils

Semi-Gloss Finish/Latex
Primer: Benj. Moore Fresh Start Latex Primer (0023)
PPG Seal Grip Int./Ext. Acrylic Universal Primer/Sealer 17-921
S-W Multi-Purpose Latex Primer/Sealer B51 Series
First Coat: Benj. Moore Ultra Spec 500 Interior Latex Gloss (N540)
PPG Speedhide Zero Interior Semi-Gloss Latex, 6-4510XI
S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series
Second Coat: Benj. Moore Ultra Spec 500 Interior Latex Gloss (N540)
PPG Speedhide Zero Interior Semi-Gloss Latex, 6-4510XI
S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series
a. Total DFT not less than: 3.8 mils

G. Primer for Fiberglass Faced Drywall:

1 coat Benjamin Moore 046 Fresh Start Acrylic All-Purpose High Hiding Primer
1 coat PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer 17-921
1 coat Sherwin Williams "Builders Solution."

H. Interior Drywall to Receive Wallcovering

Primer: 1 coat "Shield Z Mold and Mildew Proof Commercial Wallcovering Primer" made by Zinsser

1 coat Multi-Purpose Interior/Exterior B51-450 by Sherwin Williams

I. Concrete Floor Paint

Primer: Corotech V155 Solid Epoxy Pre-Primer
First Coat: Corotech V440 Waterborne Amine Epoxy
Second Coat: Corotech V440 Waterborne Amine Epoxy
Non-Slip Aggregate: Broadcast Corotech V630 Anti-Slip Aggregate.

PPG Paints
Primer: 1 Coat-PPG Megaseal HSPC 0 VOC Epoxy Primer/Sealer @ 6-8 mils dft
Finish: 2 Coats-PPG Aquapon WB EP Ultra Low VOC Water Based Semi-Gloss/Gloss Epoxy, 98-51E Series.@ 2-4 mils DFT; VOC 26g/l
Non-Slip: Add PPG Amercoat 886 Anti-Slip Additive (pumice) into the first coat of epoxy finish.

J. Concrete Floor Sealer: Two coats, Super Diamond VOX by Euclid Chemical or approved equal.

2.5 EXISTING SURFACES TO BE PAINTED

A. Existing surfaces shall be painted in accordance with schedule given in Article 2.4 herein except that first or prime coat may be eliminated where existing paint is sound. Where existing paint must be removed down to base material, provide first or prime coat as specified.

2.6 PIPING AND MECHANICAL EQUIPMENT EXPOSED TO VIEW

A. Paint all exposed piping, conduits, ductwork and mechanical and electrical equipment. Use heat resisting paint when applied to heating lines and equipment. The Contractor is cautioned not to paint or otherwise disturb moving parts in the mechanical systems. Mask or otherwise protect all parts as required to prevent damage.

B. Exposed Uncovered Ductwork, Piping, Hangers and Equipment: Latex Enamel Undercoater and one (1) coat Acrylic Latex Flat.

C. Exposed Covered Piping, Duct Work and Equipment: Primer/Sealer and one (1) coat Acrylic Latex Flat.

D. Panel Boards, Grilles and Exposed Surfaces of Electrical Equipment: Latex Enamel Undercoater and two (2) coats Latex Semi-Gloss.

E. Equipment or Apparatus with Factory-Applied Paint: Refinish any damaged surfaces to match original finish. Do not paint over name plates and labels.

F. All surfaces of insulation and all other work to be painted shall be wiped or washed clean before any painting is started.

G. All conduit, boxes, distribution boxes, light and power panels, hangers, clamps, etc., are included where painting is required.

H. All items of Mechanical and Electrical trades which are furnished painted under their respective Contracts shall be carefully coordinated with the work of this Section so as to leave no doubt as to what items are scheduled to be painted under this Section.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 GENERAL WORKMANSHIP REQUIREMENTS

A. Only skilled mechanics shall be employed. Application may be by brush or roller. Spray application only upon acceptance from the Architect in writing.

B. The Contractor shall furnish the Architect a schedule showing when he expects to have completed the respective coats of paint for the various areas and surfaces. This schedule shall be kept current as the job progresses.

C. The Contractor shall protect his work at all times, and shall protect all adjacent work and materials by suitable covering or other method during progress of his work. Upon completion of the work, he shall remove all paint and varnish spots from floors, glass and other surfaces. He shall remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and shall leave his part of the work in clean, orderly and acceptable condition.

D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide ample in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.

E. Remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

F. All materials shall be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.

G. Coverage and hide shall be complete. When color, stain, dirt or undercoats show through final coat of paint, the surface shall be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Owner.

H. All coats shall be dry to manufacturer’s recommendations before applying succeeding coats.

I. All suction spots or “hot spots” in plaster after the application of the first coat shall be touched up before applying the second coat.

J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

3.3 PREPARATION OF SURFACES

A. Existing Surfaces: Clean existing surfaces requiring paint or finishing, remove all loose and flaking paint or finish and sand surface smooth as required to receive new paint or

finish. No “telegraphing” of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, Contractor shall be required to sand smooth and re-finish until surface meets with Architect’s approval.

B. General

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished shall be perfectly dry, clean and smooth.

2. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer’s instructions and as herein specified, for each particular substrate condition.

3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.

C. Metal Surfaces

1. Weld Fluxes: Remove weld fluxes, splatters, and alkali contaminants from metal surfaces in an approved manner and leave surface ready to receive painting.

2. Bare Metal: Thoroughly clean off all foreign matter such as grease, rust, scale and dirt before priming coat is applied. Clean surfaces, where solder flux has been used, with benzene. Clean surfaces by flushing with non-hydrocarbon based cleaner. For aluminum surfaces, wipe down with an oil free solvent prior to application of any pre-treatment.

   a. Bare metal to receive high performance coating specified herein must be blast cleaned SSPC SP-6 prior to application if field applied primer; coordinate with steel trades furnishing ferrous metals to receive this coating to ensure that this cleaning method is followed.

3. Shop Primed Metal: Clean off foreign matter as specified for "Bare Metal." Prime bare, rusted, abraded and marred surfaces with approved primer after proper cleaning of surfaces. Sandpaper all rough surfaces smooth.

4. Galvanized Metal: Prepare surface as per the requirements of ASTM D 6386.

5. Metal Filler: Fill dents, cracks, hollow places, open joints and other irregularities in metal work to be painted with an approved metal filler suitable for the purpose and meeting the requirements of the related Section of work; after setting, sand to a smooth, hard finish, flush with adjoining surface.

D. Plaster Surfaces: Scrape off all plaster nibs or other projections and sand smooth or finish to match adjoining surface texture. Cut out all scratches, cracks, holes, depressions and similar voids and fill with non-shrinking grout, spackles, patching plaster or other approved patching material; allow to dry, refill if necessary, then sand smooth (or refinish) to provide a flush, smooth surface of the same texture as the adjacent plaster surface.

1. Allow at least 28 days, from installation of final plaster coat, before starting work.

E. Gypsum Drywall Surfaces: Scrape off all projections and splatters, spackles all holes or depressions, including taped and spackled joints, sand smooth. Conform to standards established in Section 092900, "Gypsum Drywall."

F. Wood Surfaces: Sand to remove all roughness, loose edges, slivers, or splinters and then brush to remove dust. Wash off grease or dirt with an approved cleaner. Fill all cracks, splits, nail holes, screw holes, and surface defects with putty after the priming coat has been applied. Putty shall be brought up flush with the surface and sanded smooth and touched-up with primer when dry.

G. Block Masonry Surfaces: Thoroughly clean off all grit, grease, dirt mortar drippings or splatters, and other foreign matter. Remove nibs or projections from masonry surfaces. Fill cracks, holes or voids not filled under the "Masonry" Section, with Portland cement grout, and bag surface so that it has approximately the same texture as the adjacent masonry surface.

H. Testing for Moisture Content: Contractor shall test all plaster, masonry, and drywall surfaces for moisture content using a reliable electronic moisture meter. Contractor shall also test latex type fillers for moisture content before application of top coats of paint. Do not apply any paint or sealer to any surface or to latex type filler where the moisture content exceeds seven (7) percent as measured by the electronic moisture meter.

I. Touch-Up: Prime paint all patched portions in addition to all other specified coats.

3.4 MATERIALS PREPARATION

A. Mix and prepare painting materials in strict accordance with the manufacturer’s directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

C. Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film which may form on the surface into the material. Remove the film and, if necessary, strain the material before using.

D. Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are to be applied. Tint undercoats to match the color of the finish coat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.5 APPLICATION

A. General

1. Apply paint by brush or roller in accordance with the manufacturer’s directions. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the paint manufacturer for material and texture required.

2. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried. Sand between each enamel or varnish coat application with fine sandpaper, or rub surfaces with pumice stone, where required to produce an even, smooth surface in accordance with the coating manufacturer’s directions.

3. Apply additional coats when undercoats, stains, or other conditions show through

the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.

4. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.

   a. "Exposed surfaces" is defined as those areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, etc., are in place in areas scheduled to be painted.

5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint, before final installation of equipment.

6. Paint the back sides of access panels, removable or hinged covers to match the exposed surfaces.

7. Finish doors on tops, bottoms, and side edges the same as the faces, unless otherwise indicated.

8. Enamel finish applied to wood or metal shall be sanded with fine sandpaper and then cleaned between coats to produce an even surface.

9. Paste wood filler applied on open grained wood after beginning to flatten, shall be wiped across the grain of the wood, then with a circular motion, to secure a smooth, filled, clean surface with filler remaining in open grain only. After overnight dry, sand surface with the grain until smooth before applying specified coat.

B. Scheduling Painting

1. Apply the first coat material to surfaces that have been cleaned, pre-treated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

2. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Prime Coats: Re-coat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn- through or other defects due to insufficient sealing.

D. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage.

E. “Touching-Up” of Factory Finishes: Unless otherwise specified or shown, materials with a factory finish shall not be painted at the project site. To “touch-up,” the Contractor shall use the factory finished material manufacturer’s recommended paint materials to repair abraded, chipped, or otherwise defective surfaces.

3.6 APPLICATION OF ELECTROSTATIC PAINT

A. Preparation: Sand, or chemically clean as appropriate, all abraded surfaces, corroded areas and other imperfections in surfaces to be coated. Fill or feather edges of sanded

areas to produce for a smooth transition to bare metal.

B. Apply prime and finish materials in accordance with manufacturer's directions. Apply each material at not less that the manufacturer's recommended spreading rate. Use special equipment, applicators, and techniques recommended by manufacturer as best suited for the particular applications.

C. Apply additional coats beyond scheduled requirements when undercoating, stains or other conditions show through final paint coat until the special coating is of uniform finish, color and appearance.

3.7 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by the painting and finishing work. Leave all such work undamaged. Correct any damages by cleaning, repairing or replacing, and repainting, as acceptable to the Architect.

B. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.8 CLEAN UP

A. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

B. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END OF SECTION

SECTION 099114 - EXTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface preparation and application of paint systems on **the following exterior substrates:**
   a. Steel and iron.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of topcoat product.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

2. Final approval of color selections will be based on mockups.

   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

A. MPI Standards: Provide products complying with MPI standards indicated and listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: **As selected by Architect from manufacturer's full range**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

B. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions and recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Steel and Iron Substrates:

1. Water-Based Light Industrial Coating System **MPI EXT 5.1B**

a. Zinc-Rich Prime Coat: Primer, zinc rich, inorganic**, MPI #19**.

b. Alkyd Prime Coat: Primer, alkyd, anti-corrosive for metal**, MPI #79**.

c. Water-Based Prime Coat: Primer, rust inhibitive, water based **MPI #107**.

d. Epoxy Prime Coat: Primer, epoxy, anti-corrosive **MPI #101**.

e. Shop Prime Coat: Shop primer specified in Section where substrate is specified.

f. Semigloss Topcoat: Light industrial coating, exterior, water based, semigloss MPI Gloss Level 5**, MPI #163**.

END OF SECTION 099114

SECTION 101100

VISUAL DISPLAY SURFACES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the visual display surfaces as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Glass marker board magnetic surface.

1.3 RELATED SECTIONS

A. Masonry - Section 042000.

B. Drywall - Section 092900.

1.4 QUALITY ASSURANCE

A. Qualifications of Installers: For installation of markerboards and tackboards, use only personnel who are thoroughly trained and experienced in the skills involved and who are completely familiar with the manufacturer's recommended methods of installation.

B. Installation Methods: The recommended installation methods of the manufacturer shall become the basis for acceptance or rejection of actual installation methods used in the work.

C. Manufacturer: Furnish all chalkboards and tackboards by one manufacturer for entire project.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for each material and component part, including data substantiating that materials comply with requirements.

B. Shop Drawings: Submit for each type of chalkboard and tackboard. Include sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, and installation details.

C. Samples: Submit full range of color samples for each type of chalkboard, tackboard, trim and accessories required. Provide 12" square samples of sheet materials and 12" lengths of trim members for color verification after selections have been made.

1.6 SPECIAL PROJECT WARRANTY

A. Warranty on glass magnetic Markerboards: Provide written warranty, signed by manufacturer, agreeing to replace, within warranty period of twenty-five (25) years markerboards which do not retain original writing and erasing qualities, defined to include surfaces which become slick and shiny, or exhibit crazing, cracking or flaking; provide manufacturer's instructions for handling, installing, protecting and maintaining markerboards have been adhered to during the warranty period. Replacement is limited to material replacement only and does not include labor for removal and reinstallation.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

2.1 MARKERBOARDS

A. Basis Of Design: Claridge Glass Marker Board Magnetic Surface With Invisible Mount, Accessories-Magnetic Marker Tray And Magnets or approved equal.

2.2 ACCESSORIES

A. Provide clips, anchors and fasteners required for complete installation.

B. Provide tray with markers and erasers

C. Provide 6-8 magnets with each board

2.3 TACKBOARDS

A. Basis of Design: Claridge Fabric wrapped tack board FR701 2100, meets or exceeds Type 1 requirements in Federal Specification CCC-W-408A. Water based inks and coatings, water based acrylic top for improved cleanability, cadmium and mercury free, meets CA 01350 requirements, Class A ASTM E84 Test Results 25 or less flame spread, 50 or less smoke development.

2.4 FABRICATION

A. Assembly: Provide factory-assembled markerboards and tackboard units unless field-assembled units indicated.

B. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

1. Provide manufacturer's standard vertical joint system between abutting sections of chalkboard.

2. Provide mullion trim at joints between chalkboard and tackboards.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where chalkboards and tackboards are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Deliver factory-built markerboard and tackboard units completely assembled in one piece without joints, whenever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to the Architect. When overall dimensions require delivery in separate units, prefit at factory, disassembled for delivery, and make final joints at site. Use splines at joints to maintain surface alignment.

B. Install units in locations and mounting heights as shown on drawings and in accordance with manufacturer's instructions, keeping perimeter lines straight, plumb and level. Provide all grounds, clips, backing materials, adhesives, brackets, anchors, trim and accessories for complete installation.

C. Coordinate job-assembled units with grounds, trim and accessories. Join all parts with neat, precision fit.

3.3 ADJUST AND CLEAN

A. Verify accessories required for each unit properly installed and operating units properly functioning.

B. Clean units in accordance with manufacturer's instructions, breaking in only as recommended.

END OF SECTION

SECTION 101400

SIGNAGE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the signage as shown on the drawings and/or specified herein, including the following:

1. Interior panel signs.

1.3 RELATED SECTIONS

A. Exit signs - Division 26.

1.4 QUALITY ASSURANCE

A. For actual installation of signage, use only personnel who are thoroughly familiar with the manufacturer's recommended methods of installation and who are completely trained in the required skills.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for each type of signage required.

B. Samples: Submit samples of each type of signage showing finishes, colors, surface textures and qualities of manufacture and design of each sign component including graphics.

C. Shop Drawings: Submit shop drawings for fabrication and erection of signage. Include plans, elevations, and large scale details of sign wording and lettering layout. Show anchorage and accessory items. Furnish location template drawings for items supported or anchored to permanent construction.

1.6 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

1.1 INTERIOR PANEL SIGNS

A. BASIS OF DESIGN: Innterface Architectural Signs; contact Mark Hester at mhester@innerfacesign.com

B. Fire egress, floor, and other signs required by Code shall be as follows:

1. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, manufactured from manufacturer's standard acrylic sheet, unframed. Comply with requirements indicated for finishes, colors, designs, shapes, sizes, and details of construction (as selected by the Architect).

2. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth. Fill engraved copy with enamel.

3. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surfaces, in contrasting color.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where signage is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install units and components at the locations directed by the Architect, securely mounted with concealed theft-resistant fasteners. Attach to substrates in accordance with the manufacturer's instructions.

B. Install level, plumb, and at the proper height. Cooperate with other trades for installation of sign units to finish surfaces. Repair or replace damaged units as directed by the Architect.

END OF SECTION

SECTION 101453 – TRAFFIC SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This item consists of furnishing all materials, labor and equipment and performing all operations in connection with the installation of ADA signs on breakaway steel posts as shown on the drawings and in accordance with these specifications and/or as directed by the Engineer.

1.3 SUBMITTALS

A. The Contractor shall submit dated certification from the manufacturer, fabricator, or producer that flat sheet sign panels and steel posts furnished meet specifications, all in accordance with NJDOT Specifications for Roadway and Bridge Construction and the Manual on Uniform Traffic Control Devices for Streets and Highways (“MUTCD”).

B. Prior to fabrication, submit shop drawings for approval for the following items of work, in accordance with the conditions of the contract.

C. Submit shop drawings for each typical sign type as shown on the drawings. Details of the sign panels, anchorage details, footings, and other pertinent details shall be indicated on the shop drawings. Also, submit shop drawings for method of connection of sign to post, fence, or other.

D. Submit shop drawings showing message layout, letter style, and copying spacing to scale.

PART 2 - PRODUCTS

2.1 TRAFFIC SIGNS

A. The aluminum sign blanks shall conform to ASTM Specification B-209 Alloy 5052-H38.

B. The sign faces shall be fabricated from materials conforming to NJDOT Specifications.

C. The traffic signs shall be fabricated in accordance with NJDOT Specifications.

D. The sign mounting brackets, buckles, and hardware shall be stainless steel. The banding shall be 0.75” x 0.020” stainless steel. The brackets and banding shall remain the natural color.

E. Sign legends shall conform to NJDOT Specifications unless otherwise noted on the plan.

F. All signs shall be manufactured in accordance with latest retro-reflectivity requirements of NJDOT.

2.2 POSTS

A. The post shall be a 12’ long, 2” x 2” square pole, 14 gauge hot-dipped galvanized, with 7/16" holes punched on all 4 sides, 1" on center.

B. The anchor shall be a 2 1/4" x 2 1/4" x 36" square penetrator anchor post, 12 gauge hot-dipped galvanized, with 7/16" holes punched on all 4 sides, 1" on center.

C. The yield and tolerance shall conform to NJDOT Specifications.

D. The color shall be the natural galvanized steel.

2.3 HARDWARE

A. 5/16” steel corner bolts.

PART 3 - EXECUTION

3.1 GENERAL

A. All sign panel and steel post materials shall be installed as identified in NJDOT Specifications..

3.2 ADA SIGNS

A. Each ADA sign shall be mounted at a minimum height of 5’ above the sidewalk or ground to the bottom of the lowest sign unless otherwise directed by the Engineer.

B. All ADA signs shall be placed perpendicular to the curb and facing oncoming traffic, unless otherwise indicated on the plan or directed by the Engineer.

C. All bolted signs shall conform to the following:
1. Any bolted sign of a length of 23” or less shall be secured with two (2) bolts.
2. Any bolted sign of a length of 24” or greater shall be secured with three (3) bolts.
3. Each bolt shall have a washer.

D. All sign faces shall be thoroughly wiped after installation.

3.3 POSTS

A. The anchor shall be embedded in the ground and extend a maximum of 2 holes above the surface.

B. The anchor shall be connected to the post with 5/16” steel corner bolts.

C. The adjacent pavement shall be restored to its original condition.

D. Excessive damage to the existing pavement caused by the Contractor, as determined by the Engineer, shall be corrected at the Contractor’s expense.

END OF SECTION 10 14 53

SECTION 102114

TOILET PARTITIONS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the toilet partitions as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Gypsum board partitions - Section 092900.

B. Ceramic tile - Section 093000.

C. Toilet accessories - Section 102800.

1.4 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to fabrication to ensure proper fitting of the work.

B. Inserts and Anchorages: Furnish inserts and anchoring devices which must be built into other work for the installation of toilet partitions and related work. Coordinate delivery with other work to avoid delay.

1.5 SUBMITTALS

A. Shop Drawings: Before any of the materials of this Section are delivered to the job site, submit the following:

1. Room layouts and elevations for all areas, with dimensions based on actual dimensions taken at job site.

2. Materials, finishes, details of construction, gauges of metal, hardware, fastening and anchoring conditions and relation to adjoining constructions.

B. Samples: Submit the following:

1. Panel Material: 12" x 12" sample in each color.

2. One sample of each type of hardware and fitting item including related fasteners. Include all items listed under 2.2 C. below.

C. Templates: Submit templates to other trades as required for support of toilet partitions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide floor-mounted, overhead-braced, solid plastic partitions with non-corrosive doors and panels, equal to "Eclipse Partitions" by Scranton Products Inc., or comparable product by Global Partitions, Hadrian Manufacturing, Inc., or approved equal.

B. Provide wall hung urinal screens of same material as toilet partitions.

C. Manufacturer's names or identifying markings not permitted on exposed surfaces of toilet partitions, vision screens, urinal screens, or related hardware.

2.2 MATERIALS

A. Plastic Panels: High-density polyethylene (HDPE) suitable for exposed applications, waterproof, non-absorbent, and graffiti-resistant textured surface.

B. Aluminum Extrusions: ASTM B221, 6463-T5 alloy and temper.

C. Aluminum Die Castings: ASTM B85, A380 alloy.

D. Stainless Steel Castings: ASTM A167, Type 304.

E. Rubber: Abrasion resistant Styrene Butadiene Rubber, 65 to 80 Shore A durometer, black.

2.3 COMPONENTS

A. Doors and Panels: High density polyethylene (HDPE), fabricated from extruded polymer resins, forming single thickness panel.

1. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.

2. Thickness: 1 inch.

3. Edges: Shiplap.

4. Color(s): As selected by the Architect.

B. Doors and Dividing Panels: Height: 62" high and mounted at 12" above the finished floor.

C. Metal Posts: 82-3/4" high, heavy duty extruded aluminum, clear anodized finish, fastened to foot with stainless steel tamper resistant screw.

D. Hidden Shoe (Foot): One-piece molded polyethylene invisible shoe inserted into metal post and secured to metal post with stainless steel tamper resistant screw.

E. Headrail Cap and Corner Cap: One-piece molded polyethylene secured to metal post with stainless steel tamper resistant screw; adjustable to level headrail to finished floor.

F. Wall Brackets: Continuous heavy-duty extruded aluminum, clear anodized finish, inserted into slotted panel and fastened to panels with stainless steel tamper resistant screws.

G. Headrail: Heavy-duty extruded aluminum, designer anti-grip design, clear anodized finish, fastened to headrail bracket with stainless steel tamper resistant screw and to headrail cap or corner cap with stainless steel tamper resistant screw.

1. Headrail Brackets: Heavy duty extruded aluminum, clear anodized finish, secured to wall with stainless steel tamper screws.

2.4 DOOR HARDWARE

A. Door hardware shall be as follows:

1. Hinges: Edge-mounted helix style stainless steel continuous hinge.

a. Closing Degree: 5 degrees.
b. Comes to a full close on its own weight.

2. Occupancy Indicator Latch and Housing:

a. Material: Satin stainless steel.
b. Occupancy Indicators: Green for not occupied and red occupied.
c. Slide bolt and button.

3. Coat Hook and Door Bumper Combination:

a. Material: Chrome-plated Zamak.
b. Handicapped Door: Equip with second door pull and door stop.

4. Door Pulls: Chrome-plated Zamak.

2.5 FABRICATION

A. Doors and dividing panels shall be 62" high and mounted at 9" above finished floor, unless otherwise noted.

B. Color of doors and panels shall be selected by the Architect from the manufacturer's full color range.

C. Aluminum edging strips to be fastened to the bottom edge of all doors and panels using vandal-proof stainless steel fasteners.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where toilet partitions are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install work of this Section in a rigid and permanent manner, straight and plumb, with all horizontal lines level.

B. Install panels and doors fourteen (12) inches above finished floor, unless otherwise indicated. Toilet compartment doors shall be centered on water closets, unless otherwise indicated.

C. Maintain uniform clearance of approximately 1/2" between pilasters and panels, and 1/2" between pilasters or panels and finished wall.

D. Maintain uniform clearance of 1/4" or less between vertical edges of doors and pilasters.

E. Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4" into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

END OF SECTION

SECTION 102600

WALL AND CORNER GUARDS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the wall and corner guards as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Masonry - Section 042000.

B. Gypsum drywall - Section 092900

1.4 QUALITY ASSURANCE

A. Cover materials shall be classified in accordance with ASTM E 84 as to flame spread and smoke development and shall be classified as self-extinguishing in accordance with ASTM D 635.

1.5 SUBMITTALS

A. Samples: Two (2) samples of wall guards and corner guards each 12” long shall be delivered to the Architect.

B. Shop Drawings: Submit shop drawings for wall and corner guards showing all anchorage devices.

PART 2 PRODUCTS

2.1 MATERIALS

A. Wall Guards: Surface mounted wall guards with 0. 078” thick continuous extruded vinyl cover securely locked in place over concealed retainer with intermediate supports for cover. Size as indicated on the drawings.

1. Basis of Design: Construction Specialties, Inc.; Model SCR-40N

2. Other Acceptable Manufacturers:

   a. Brown Manufacturing Co.
   b. InPro

B. Corner Guards: Surface mounted corner guards with 0.078” thick continuous extruded vinyl cover. Size as indicated on the drawings.

1. Basis of Design: Construction Specialties, Inc.; Model SSM-25N

2. Other Acceptable Manufacturers:

   a. Brown Manufacturing Co.
   b. InPro

C. Color of vinyl for wall and corner guards: As selected by the Architect.

D. Vinyl covers shall be rated Class “I” as to flame spread and smoke development.

E. Provide appropriate end caps, bolts, and other required fittings.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where wall and corner guards are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Wall guards shall be installed by bolting with 1/4” toggle bolts through the retainer and the gypsum wallboard substrate. Bolts shall be 32” o.c. for wall guards and shall securely anchor wall guards. Corner guards shall be installed by self-tapping sheet metal screws through the retainer, the gypsum wallboard substrate and the metal wall stud. Screws shall be 20” o.c. for corner guards and shall securely anchor the corner guards.

B. Wall guards shall be set parallel to the floor at heights shown on the Drawings.

C. Corner guards shall be set in alignment with the corner bead of the gypsum wallboard substrate.

3.3 ADJUST AND CLEAN

A. Clean surfaces promptly after installation, exercise care to avoid damage to surfaces.

B. Protect wall and corner guards from damage until acceptance of work.

END OF SECTION

SECTION 102800

TOILET ACCESSORIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the toilet accessories as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Masonry - Section 042000.

B. Gypsum board partitions - Section 092900.

C. Ceramic tile - Section 093000.

D. Toilet partitions - Section 102114.

1.4 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

B. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to ensure proper operation and servicing of accessory units. Accessories shall be installed at heights in compliance with prevailing Handicapped Code.

C. Products: Unless otherwise noted, provide products of same manufacturer for each type of unit and for units exposed in same areas.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, catalogue cuts and installation instructions for each toilet accessory.

B. Setting Drawings: Provide setting drawings, templates, instructions, and directions for installation of anchorage devices in other work

C. Submit schedule of accessories indicating quantity and location of each item.

1.6 PRODUCT HANDLING

A. Deliver accessories to the site ready for use in the manufacturer’s original and unopened containers and packaging, bearing labels as to type or material, manufacturer’s name and brand name. Delivered materials shall be identical to approved samples.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22 gauge minimum, unless otherwise indicated.

B. Brass: ASTM B 19 flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Galvanized Steel Sheet: ASTM A 653, G60.

D. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

E. Mirrors: ASTM C 1503, mirror glazing quality, clear glass mirrors, nominal 1/4" thick.

2.2 FASTENING DEVICES

A. Exposed Fasteners: Theftproof type, chrome plated, or stainless steel; match finishes on which they are being used.

B. Concealed Fasteners: Galvanized (ASTM A 123) or cadmium plated.

C. No exposed fastening devices permitted on exposed frames.

D. For metal stud drywall partitions, provide ten (10) gauge galvanized sheet concealed anchor plates for securing surface mounted accessories.

2.3 FABRICATION

A. General: Stamped names or labels on exposed faces of toilet accessory units are not permitted. Unobtrusive labels on surfaces not exposed to view are acceptable. Where locks are required for a particular type of toilet accessory, provide same keying throughout project. Furnish two keys for each lock.

B. Surface-Mounted Toilet Accessories, General: Fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage.

C. Recessed Toilet Accessories, General: Fabricate units of all welded construction, without mitered corners. Hang doors of access panels with full-length stainless steel piano hinge. Provide anchorage which is fully concealed when unit is closed.

2.4 ACCESSORY SCHEDULE

A. Basis of Design Products: Refer to Drawings.

B. Other Acceptable Manufacturers:

1. Bobrick Washroom Equipment Co.

2. American Specialties, Inc.

3. Bradley Corp.

4. A & J Washroom Accessories

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where toilet accessories are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 PREPARATION

A. Accessories which are to be partition mounted shall be closely coordinated with other trades, so that the necessary reinforcing is provided to receive the accessories.

B. Furnish templates and setting drawings and anchor plates required for the proper installation of the accessories at gypsum drywall and masonry partitions. Coordinate the work to ensure that base plates and anchoring frames are in the proper position to secure the accessories.

C. Verify by measurements taken at the job site those dimensions affecting the work. Bring field dimensions which are at variance with those on the approved shop drawings to the attention of the Architect. Obtain decision regarding corrective measures before the start of fabrication of items affected.

D. Cooperate in the coordination and scheduling of the work of this Section with the work of other Sections so as not to delay job progress.

3.3 INSTALLATION

A. Install accessories at locations indicated on the drawings, using skilled mechanics, in a plumb, level and secure manner.

B. Concealed anchor assemblies for gypsum drywall partitions shall be securely anchored to metal studs to accommodate accessories. Assemblies shall consist of plates and/or angles tack welded to studs.

C. Secure accessories in place, at their designated locations by means of theftproof concealed set screws, so as to render removing of the accessory with a screwdriver impossible.

D. Unless otherwise indicated, accessories shall conform to heights from the finished floor as shown on the drawings. Where locations are not indicated, such locations shall be as directed by the Architect.

E. Installed accessories shall operate quietly and smoothly for use intended. Doors and operating hardware shall function without binding or unnecessary friction. Dispenser type accessories shall be keyed alike. Prior to final acceptance, master key and one duplicate key shall be given to Owner’s authorized agent.

F. The Architect shall be the sole judge of workmanship. Workmanship shall be of the highest quality. Open joints, weld marks, poor connections, etc., will not be permitted.

The Architect has the right to reject any accessory if he feels the workmanship is below the standards of this project.

G. Grab bars shall be installed so that they can support a three hundred (300) lb. load for thirty minutes per ANSI A117.1 and ADA US Department of Justice Guidelines.

3.4 CLEANING AND PROTECTION

A. Upon completion of the installation, clean accessories of dirt, paint and foreign matter.

B. During the installation of accessories and until finally installed and accepted, protect accessories with gummed canvas or other means in order to maintain the accessories in acceptable condition.

C. Replace and/or repair installed work which is damaged or defective to the Owner's satisfaction, at no additional cost.

END OF SECTION

SECTION 104416

FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the fire extinguishers and cabinets as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Masonry walls - Section 042000.

B. Gypsum drywall - Section 092900.

C. Fire suppression systems - Division 22.

D. Fire hose cabinets and valve cabinets - Division 22.

1.4 QUALITY ASSURANCE

A. Provide portable fire extinguishers, cabinets and accessories by one manufacturer.

B. UL-Listed Products: Provide new portable fire extinguishers which are UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for all portable fire extinguishers required. For fire extinguisher cabinets include roughing-in dimensions, and details showing mounting methods, relationships to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, style and materials. Where color selections by Architect are required, include color charts showing full range of manufacturer's standard colors and designs available.

B. Samples: Submit samples, 6" square, of each required finish. Prepare samples on metal of same gauge as metal to be used in the work. Where normal color variations are to be expected, include 2 or more units in each sample showing the limits of such variations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following:

1. J.L. Industries.

2. Larsen's Mfg. Co.

3. Potter Roemer.

2.2 EXTINGUISHERS

A. General: Provide fire extinguishers for each extinguisher cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard which comply with requirements of governing authorities.

B. Abbreviations indicated below to identify extinguisher type related to UL classification and rating system and not necessarily to type and amount of extinguishing material contained in extinguisher.

C. Multi-Purpose Dry Chemical Type: UL rated 2A-10B:C, 5 lb. nominal capacity, in enameled steel container, for Class A, Class B and Class C fires.

2.3 MOUNTING BRACKETS

A. Provide manufacturer's standard bracket designed to prevent accidental dislodgment of extinguisher, of proper size for type and capacity of extinguisher specified, in manufacturer's standard enamel finish; color to match extinguisher.

2.4 CABINETS

A. Type and Style: Fire extinguisher cabinets shall be metal, semi recessed, with plexiglass panel, sized to fit within the partition or wall depth. Provide fire rated cabinets within fire rated partitions.

B. Color: Fire extinguisher cabinets shall be factory pre-finished with baked enamel in the colors selected by the Architect from the standard range of colors of the selected manufacturer.

C. Design is based on "Model G-2409-5R" of Larsen's Mfg. Co. Other manufacturers noted herein may substitute their equivalent cabinet upon acceptance by the Architect.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where fire extinguishers and cabinets are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install items included in this Section in locations indicated and at heights to comply with applicable regulations of governing authorities.

1. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.

2. Securely fasten mounting brackets and fire extinguisher cabinets to structure,

square and plumb, to comply with manufacturer's instructions.

B. Where exact location of cabinets and bracket-mounted fire extinguishers is not indicated, locate as directed by the Architect.

3.3 IDENTIFICATION

A. Identify fire extinguisher in cabinet with lettering spelling "FIRE EXTINGUISHER" painted on door by silk-screen process or die cut lettering. Provide lettering on door as selected by Architect from manufacturer's standard letter sizes, styles, colors and layouts.

B. Identify bracket-mounted extinguishers with red letter decals spelling 'FIRE EXTINGUISHER' applied to wall surface. Letter size, style and location as selected by the Architect.

3.4 SERVICE

A. Determine the approximate completion date of the work and then inspect, charge, and tag the fire extinguishers at a date not more than 10 days before or not less than one day before actual completion date of the work.

END OF SECTION

SECTION 122413

WINDOW TREATMENTS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the window treatments as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Manually-operated window dual roller shades.
2. Manually-operated window single roller shades.
3. Electrically-operated window single roller shades.
4. Privacy screens for vision lites.
5. Field measurements of as-built conditions.
6. Accessories and hardware required for complete installation and operation.

1.3 RELATED SECTIONS

A. Electrical - Division 26.

1.4 QUALITY ASSURANCE

A. Provide assemblies which are complete assemblies produced by one manufacturer, including hardware, accessory items, mounting brackets, and fastenings.

B. Provide materials in colors as selected by the Architect from manufacturer's standard colors.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

1. Motorized Shade Operators: Include operating instructions.
2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: Submit floor layout and elevations, indicating location of all window treatments, mechanism details, type and size of each unit, type and location of controls. Shop drawings must also show seaming of shade fabric. Submit shop drawings showing details of installation and relation to adjoining construction and conditions.

C. Samples: Submit full size sample of each shade type for Architect's acceptance.

D. Mock-Up

1. Install each type of shade assembly on one complete column bay for Architect's acceptance of installation details, workmanship and operation.

2. Approved mock-up shall be used as the standard for installation of work under this Section, and no further installation work shall proceed before Architect's acceptance of the mock-up.

1.6 WARRANTY

A. Manufacturer’s standard non-depreciating 25-year limited warranty covering all hardware, motors, motor control system and shade cloth.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protect shades from damage, soiling and deterioration during transit, storage and handling to, until Owner's acceptance.

PART 2 PRODUCTS

2.1 MANUALLY OPERATED SHADES

A. Basis of Design: Mecho-Shade Corp.; Mechoshade/5 System.

B. Other Acceptable Manufacturers:

1. Rollease Acmeda; Contract Series 1

2. Sol-R-Veil Inc.

3. Draper

4. WT Shade

C. Shade system shall be pre-engineered overrunning clutch design that disengages to 90% during the raising and lowering of the shade. The brake can stand a pull force of 40 lb. in the stop position, or sized as required for shade weight, requiring no adjustment. Self-lubricating hub on to which the brake system is mounted includes an articulated brake assembly which ensures smooth, non-jerky operation in raising and lowering the shades. System shall include the following components:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing mounting hardware from opening and without requiring end or center supports to be removed.

2. Provide shade hardware that allows for removal and remounting of the shade bands without having to remove the shade tube, drive or operating support brackets.

3. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.

4. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.

5. Provide shade hardware system that allow for operation of multiple shade bands (multi-banded shades) by a single chain operator. Connectors shall be offset to ensure alignment from the first to the last shade band.

6. Provide shade hardware constructed of minimum 1/8" thick plated steel or heavier as required to support 150% of the full weight of each shade.

7. Drive Bracket/ Brake Assembly:

   a. MechoShade Drive Bracket M5, WT Shade SoloMount, or equal by other manufacturers noted herein.
   b. Rollease Acmeda chain driven clutch operating system of self-lubricating, uv stabilized fiberglass reinforced nylon construction and tempered high carbon steel internal springs, designed for smooth, trouble-free operation, precise control, and uniform aesthetics. Galaxy geared or spring boost counter balance system to achieve < 6 lbs. constant pull forcesDrive Chain: #10 qualified stainless steel chain rated to 90 lb.
   c. Minimum Breaking Strength: Nickel plate chain shall not be accepted.

D. Configuration:

1. Single Roller Configuration:

   a. Mounting: Endcaps and fascia.
   b. Brackets: Plated stamped steel. Provide size compatible with roller size.
      1). Mounted to ceiling.
      2). Mounted to wall.
      3). Mounted to jamb.
   c. Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb. Provide size compatible with roller size.
      1). Endcap covers: To match fascia or headbox color.
   d. Fascia: L shaped aluminum extrusion to conceal shade roller and hardware.
      1). Attachment: Snaps onto endcaps without requiring exposed fasteners of any kind. Fascia can be mounted continuously across two or more shade bands. No notching is required.
      2). Shape: Square Fascia Panel.
      3). Finish: As selected by the Architect.

2. Dual Roller.

   a. Mounting.

1). Dual roller fascia. Endcaps with fascia designed for surface mounting of dual roller window shades.

(a). Endcaps: 1028 steel stamping.
(b). Fascia: L-shaped cover of extruded aluminum, .060 wall. Assembly snaps onto endcaps without exposed fasteners.
(c). Finish: Powder coat.
(d). Finish: Selected from Manufacturers standard range.
(e).

E. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be the same, for all shades within one room.

2. Shade Band and Shade Roller Attachment:

a. Provide extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without deflection. Provide for positive mechanical engagement with drive/ brake mechanism.
b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable/ replaceable with a snap-on/snap-off spline mounting, without having to remove shade roller from shade brackets.
c. Mounting spline shall not require use of adhesives, adhesive tapes, staples and/or rivets.

2.2 ELECTRICALLY OPERATED SHADES

A. Basis of Design: Mecho-Shade Corp.; ElectroShade.

B. Other Acceptable Manufacturers:

1. Rollease Acmeda; Automate

2. Lutron

3. Sol-R-Veil Inc.

C. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.

2. Provide shade hardware that allows for removal and remounting of the shade bands without having to remove the shade tube, drive or operating support brackets.

D. Motorized Shade Hardware and Shade Brackets:

1. Provide shade hardware constructed of minimum 1/8" thick plated steel, or heavier, thicker, as required to support 150% of the full weight of each shade. Plastic components without use of steel angle construction do not meet the intent of this specification and shall not be accepted.

2. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).

3. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8-45 degrees from the motor axis between shade bands (4-22.5 degrees) on each side of the radial line, by a single shade motor.

    a. Provide one shade band per window unit up to six shade band units per motor.
    b. All shade bands within a single motor group shall be aligned within ¼".

E. Shade Motors:

1. Intelligent Encoded Motor and Control System: Tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor operating at 110v AC (60 Hz), or 24-35v DC motor single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.

2. Conceal motors inside shade roller tube.

3. Maximum current draw for each shade motor of 2.3 amps. Motors shall not exceed 44 dBA measured from 3 feet from the motor.

4. Use motors rated at the same nominal speed for all shades in the same room

F. Intelligent Encoded Motor System:

1. Upper and lower stopping points (operating limits) of shade bands shall be programmed into motors via a hand held removable program module/ configurator.

2. Intermediate stopping positions for shades shall be a minimum of 4 predefined intermediate positions, for a total of 6 defined and aligned positions. All shades shall have hembars fully aligned at all stop points and during travel to stop points.

3. Encoded Motors shall be addressable via a hand held removable program module and shall be capable of responding to a minimum of seven different user defined stored addresses including multiple overlapping sub groups and three reserved control input address for use by building management systems, life safety systems and other emergency inputs.

4. The system shall have the capability of two-way communication with the motors. Each motor shall allow for a unique address message to be received from the hand held configurator and/or a PC controller or switch.

    a. Bus line shall consist of 2 twisted pair of 16 gauge low voltage wire or wireless bi-directional communication over 433.92 mhz radio frequency with Frequency-Shift Keying (FSK) RF modulation.

    b. Shade motor control components (bus interfaces, wall switches, bus supplies, auxiliary control input devices) shall be connected in series via the low voltage (12 VDC) two way digital communication bus line or via wireless bi-directional communication over 433.92 mhz radio frequency with Frequency-Shift Keying (FSK) RF modulation.
    c. Bus line shall be capable of being installed I a free topology to provide maximum flexibility for installation and future maintenance unless bi-directional wireless communication is used.

d. Low voltage (12VDC), digital bus line shall be powered by a bus supply transformer, requiring 115VAC (220-230 VAC) input drawing a maximum current of 1 amp. A minimum of one bus supply shall be required for every 400 linear feet of bus line. Final bus supply spacing shall be reviewed with the system manufacturer after the number of nodes per 400 ft. run of bus line has been determined.

5. Wall Switches:

a. Where noted shades shall be operated by a 4 and 8 button low voltage standard switches or programmable intelligent switches (IS). Standard switch shall be wired to a bus interface and the bus interface will be programmed to transmit an address for the local switch.
b. Intelligent switches may be installed anywhere on the bus line. Each IS shall be capable of storing one control level address to be broadcast along the bus line.
c. An address that is transmitted by either a switch or central controller shall be responded to by those motors with the same address in their control table.
d. IS shall provide for interface with other low voltage input devices via a set of dry contact terminals located on the switch.
e. Standard switch or IS may control an individual, sub-group or group of motors in accordance with the address in each motor.
f. Where noted shades shall be operated by 1, 2, 5, or 16 channel battery powered RF switch for local, zone or direct control.

G. Shade Band: As described herein for manual shades.

H. Finishes: Unless otherwise noted, all exposed aluminum parts have an anodized finish. Steel parts are either nickel plated, satin finish, or have been bonderized prior to painting with a baked, enamel finish.

I. Side Channels: Provide standard "blackout" side channels where black-out shades are required. Channels shall be extruded aluminum, with a black anodized finish, color selected by the Architect.

2.3 SHADE CLOTH

A. Solar and Black Out shade cloth

1. Basis of Design: See fin schedule.

2.4 FABRICATION

A. The shade and the fabric shall hang flat without buckling or distortion. The edge, when trimmed, shall hang straight without curling or raveling. An unguided roller shade cloth shall roll true and straight, without tracking sideways more than +/- 1/8" in either direction due to warp distortion or weave design. Shades shall fill window openings from head to sill and jamb to jamb.

2.5 PRIVACY SCREENS

A. Basis of Design: Activar Construction Products Group, Inc.; Velo Privacy Screens for Vision Lites - PS

1. Material: 18 gauge aluminum frame.

2. Construction: 1-1/4" x 1/4" frame on 4 sides with radius corners, mitered and welded; 7/8" deep slots on both sides.

3. Roller: Spring-operated roller in an aluminum housing with black end caps, with push-button closer to rewind shade. Roller unit extends 1" from frame face.

4. Shade: 100% opaque, light blocking fabric material is attached to a rigid pull-down bar mounted into the side channels. Shade shall slide up and down and lock into position when pulled down to any position.

5. Powder Coat Finish: Color as selected by the Architect.

6. Size: 12-5/8" x 30-5/8".

7. Installation: Attach to installed vision lite using 5/8" 3M Dual Lock fasteners provided.

8. UL Listing 90 Minutes: Tested to maintain existing door, vision kit and glazing ratings up to 90 minutes for steel and wood doors, both temp-rise and non-temp- rise. Privacy Screen must be attached to a metal vision frame kit, not to the door itself, wood vision frame kits, or to wood stops.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where window treatments are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION: GENERAL

A. Coordinate with the work of other trades to ensure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the indicated design and the installation recommendations of the manufacturer as approved by the Architect.

C. Upon completion of the installation, put all components through at least ten (10) complete cycles of operation, adjusting as necessary to achieve optimum operation.

3.3 INSTALLATION OF MANUAL ROLLER SHADES

A. Install roller shades level, plumb, square, and true according to manufacturer’s written instructions and located so shade band is not closer than 2" to interior face of glass. Allow proper clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces after installation, according to manufacturers written instructions.

3.4 INSTALLATION OF MOTOR OPERATED SHADES

A. Install roller shades level, plumb, square, and true according to manufacturer’s written instructions and located so shade band is not closer than 2" to interior face of glass. Allow proper clearances for window operation hardware.

B. To control the responsibility for performance of motorized roller shade systems, the Contractor shall assign the engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and his authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage or low voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacture. Coordinate the following with the roller shade installer/dealer:

1. Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.

2. Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.

3. Roller shade installer/dealer shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.

4. Roller shade installer/dealer shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/control locations designated by the Architect. All above ceiling and concealed wiring shall be plenum rated, or installed in conduit, as required by the electrical code having jurisdiction.

5. Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.

C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

D. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

E. Engage installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.5 PROTECTION AND CLEANING

A. Protect installed units to ensure proper operating condition, without damage or blemishes. Repair or replace damaged units as directed by the Architect.

END OF SECTION

SECTION 123220 - PLASTIC LAMINATE FACED CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Fabricated plastic laminate keyed cabinet units with plastic laminate counter tops:
a. Classroom.
b. Offices.
2. Refer to drawings for interior room elevations, room plans and casework layout.

1.2 SUBMITTALS

A. Shop Drawings:
1. Indicate casework locations, large scale plans, elevations, cross sections, shelving, plumbing and electrical rough-in and anchor placement dimensions and tolerances and clearances.

B. Product Data:
1. Submit component dimensions, configurations, construction details, joint details, and attachments, utility and service requirements and locations.

C. Samples:
1. Submit two standard sample chains of manufacturer’s full color range of plastic laminated colors and patterns for cabinet and counter top selections. Colors will be selected by Architect.
2. Submit two panels, 6 x 6 inches in size illustrating cabinet colors, patterns and finishes as selected by Architect.
3. Submit two samples of plastic laminate, 6 x 6 inches in size illustrating counter top colors and patterns and finishes as selected by Architect.
4. Submit one full size base cabinet with drawer and pair of doors illustrating cabinet construction, hardware, keying and finish, including one exposed end panel.

D. Manufacturer's Installation Instructions:
1. Submit special installation requirements.

1.3 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

B. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept casework on site. Inspect on arrival for damage.

B. Coordinate size of access and route to place of installation.

1.6 COORDINATION

A. Coordinate casework installation with size, location and installation of service utilities.

B. Sequence installation to accommodate required utility connections.

PART 2 - PRODUCTS

2.1 CABINET MATERIALS

A. Manufacturers: Provide one of the following:
1. LSI Corporation of America (Basis of base bid specification and coordinate model numbers on drawing.
2. Case Systems Inc.
3. TMI Systems Design Corp.
4. Or approved equal.

B. Plastic Laminate Finish Sheet: V32 grade, for exterior cabinet surfaces, meeting NEMA Standards for vertical grade. Color, pattern and texture as selected.

C. Plastic Laminate Balancing Sheet: Heavy gauge putty colored plastic laminate backing sheet, textured surface, meeting NEMA Standards, type and thickness to balance face finish.

D. Plastic Fused Laminate: Putty color, colorfast thermosetting acid resistant pressure fused laminate, permanently bonded to substrate.

E. High Performance Particle Board Core: 3 ply, 47 pound density minimum, balanced construction with moisture content not to exceed 8 percent; meeting Commercial Standard CS-236, Federal Specifications LLL-B-800A, and ASTM D1037.

F. Fiberboard: Uniform density; 355 lbs screw holding capacity, 4,500 psi modulus of rupture, and 100 psi internal bond.

G. Edging: Solid, high impact, purified, color-thru, acid resistant, PVC 3 mm edging machine applied with hot melt adhesive, automatically trimmed face, back and corners for uniform appearance. Color as selected.

H. Hardware:
1. Hinges: Totally concealed heavy gauge self closing type; fully adjustable for clockwise, counterclockwise, toe-in and out door alignment.
2. Pulls: 4 inch, projecting type, dull chrome finish.
3. Sliding Door hardware:
   a. Frameless 1/4 inch thick tempered glass doors, with double track rolling door assembly.
   b. Framed 13/16 inch thick stile and rail sliding doors; top mounted track with dual roller hangers, vertical adjustment for accurate alignment.

4. Drawer Slides:
   a. Standard Drawers: Epoxy coated metal type to match drawer body color; positive in-stop, out-stop and out-keeper to maintain drawer in 80 percent open position. Captive nylon rollers front and rear. Slides must be capable of supporting a minimum dynamic load rating of 100 pounds.
   b. File Drawers: Epoxy coated metal type. Full extension, 3 part progressive opening slide. Slides must be capable of supporting a minimum dynamic load rating of 100 pounds.
5. Catches:
   a. Base and Wall Cabinets: Magnetic catch with 6 pounds pull force.
   b. Tall Cabinets: Magnetic catch with 7 pounds pull force, two per door.
   c. Mobile Cabinets: Roller catch.
6. Adjustable Shelf Clips: Molded nylon, anti-shelf tip up feature, 300 pound load rating, heavy duty twin pin shelf support clip with locking tab for 3/4 and 1 inch adjustable shelves.

J. Locks: Disc tumbler key operated type, dull chrome finish. Keyed alike and master keyed per Owner's instructions.

L. Sealants: Specified in Section 07 90 00.

2.2 CABINET COMPONENT CONSTRUCTION

A. Sub-base: Separate and continuous type constructed of water-resistant exterior grade plywood with concealed fastening to cabinet bottom. Ladder type construction for front, back and intermediates to form a level secure platform.

B. Top and Bottom: Base cabinet bottoms 3/4 inch thick putty colored pressure fused laminated particle board interior side; phenolic backer sheet on concealed side. Base cabinet and tall cabinet sub-tops 3/4 inch thick putty colored. Wall cabinets 1 inch thick. Exterior exposed wall cabinet bottoms putty colored pressure fused laminated particle board both sides. Assembly devices totally concealed on bottom side of wall cabinets.

C. Cabinet Ends: interior side; phenolic backer sheet on concealed side. Holes drilled for adjustable shelves 1-1 /4 inches on center. Exposed exterior ends laminated with plastic laminate.

D. Shelves: 3/4 inch thick putty colored pressure fused laminated plywood both sides. Leading

exposed edge PVC.

E. Cabinet Backs: 1/2 inch thick, prefinished putty. Rear, unexposed side of back to receive continuous bead of hot melt adhesive at joint between back and sides, top and bottom. Exposed exterior backs 3/4 inch thick particle board faced with high pressure plastic laminate.

F. Keyed, Lockable Door and Drawer Fronts: 13/16 inch thick with plastic laminate pressure fused to particle board exterior side; putty colored heavy gauge balancing sheet on interior face. Drawers and doors are to overlay the cabinet body; maintain a 1/8 inch reveal between pairs of doors, between door and drawer fronts and between multiple drawer fronts within the cabinet.

G. Keyed, Lockable Drawers: Drawer fronts applied to separate drawer body component sub-fronts. Sides and back of drawers 1/2 inch thick pressure fused putty laminated fiberboard. Sub-front 5/8 inch thick pressure fused putty laminated fiberboard. Exposed top edge of drawers flat edge PVC. Drawer sides dadoed to receive front and back, machine squared and held in place under pressure while pinned and glued. Drawer bottom 1/4 inch thick putty color pressure fused laminated surface, housed into front, sides and back, and continuously glued on underside. Reinforce drawer bottoms as required with intermediate spreaders. All drawers shall have roller guides.

2.3 CABINET CONSTRUCTION

A. Accurately machine and border cabinet parts to provide premium grade quality joinery construction. Dowel end panels to receive bottom and top. Fully house back panels into and recess 7/8 inch from back of cabinet sides, top and bottom.

B. Set glass in doors with gasket and removable stops to minimize rattles or vibration.

2.4 COUNTER TOPS

A. Plastic Laminate: NEMA LD-3 general-purpose grade plastic laminate sheet 0.050 inch thick for flat tops.

B. Countertops, Backsplash, End Splash and Box Curbs: Shop apply plastic laminate to 3/4 inch thick plywood, apply backer sheet to reverse side of board. Build up exposed countertop edges to 1-1/4 inches thick. Solid high impact purified color-thru acid resistant PVC 3 mm edge machine applied with hot melt adhesive trimmed and cut for uniform appearance (N.O.N.) Color as selected from manufacturer's full range of colors. Fabricate tops in maximum practical lengths.

2.5 CABINET AND COUNTER TOP FINISHES

A. Colors and patterns will be selected from full range of plastic laminates of the following manufacturers:
1. Wilsonart.
2. Formica Corporation.
3. Nevamar Corp.
4. Or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that areas are ready to receive casework.

B. Verify locations of mechanical and electrical fixtures.

C. Provide supplementary support framing.

3.2 INSTALLATION

A. Set and secure casework in place, rigid plumb, and level.

B. Use concealed joint fasteners to align and secure adjoining cabinet units.

C. Carefully scribe casework which abuts other building materials, leaving gaps of 1/32 inch maximum. Apply matching filler pieces where casework abuts dissimilar construction. Close ends of units, splash aprons, counter tops and splashes, and bases with sealant.

D. Secure cabinets to floors and walls using appropriate anchorage.

E. Install counter tops and secure to base cabinets.

F. Provide cutouts in counter tops for fixtures and outlets.

G. Install fixtures and fittings built into or part of casework. Provide access panels for maintenance of utility service and mechanical and electrical components. Make all connections.

3.3 ADJUSTING

A. Adjust moving and operating parts to function smoothly and correctly.

B. Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function smoothly.

3.4 CLEANING

A. Clean casework, counters, shelves, glass, legs, hardware, fittings and fixtures.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not permit finished casework to be exposed to continued construction activity.

END OF SECTION 12 32 20

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes and end splashes.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
1. Type: Provide Standard type or, as indicated unless Special Purpose type is indicated.
2. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
3. Colors and Patterns: As selected by Architect from manufacturer's full range.

B. Particleboard: ANSI A208.1, Grade M-2.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Configuration:

1. Front: 3/4-inch bullnose

2. Backsplash: Straight, slightly eased at corner

3. End Splash: Matching backsplash.

C. Countertops: 3/4-inch-thick, solid surface material with front edge built up with same material.

D. Backsplashes: 3/4-inch-thick, solid surface material.

E. Joints: Fabricate countertops without joints.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

2.1 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive.

F. Install aprons to backing and countertops with adhesive.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

H. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 210000 – FIRE PROTECTION SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Conditions, and other Divisions Specification Sections, apply to this Section.

B. The requirements of all other sections of Division 21 apply to this section.

1.2 WARRANTY FOR PROJECT

A. The Contractor shall provide the Owner with a 2 year warranty on all materials, labor and systems from the date of Substantial Completion. The date of Substantial completion will be as set in a letter issued by the Architect – no exceptions.

1.3 DEFINITIONS

A. For a complete list of definitions for this contract refer to the Division 1 specifications.

B. Provide: Means to provide, install and make the equipment/system completely functional and operational with testing, commissioning and training.

C. Install: Means to provide, install and make the equipment/system completely functional and operational with testing, commissioning and training.

1.4 SCOPE OF WORK

A. Work Included: It is the intent of these specifications and the accompanying drawings that the Contractor shall, unless otherwise specified herein, furnish all labor, materials, tools, and equipment necessary, together with the necessary accessories to constitute a satisfactory and complete installation, to complete the installation of the fire protection work, as indicated on the drawings and described hereinafter. The Contractor shall properly install, equip, adjust and put in perfect condition the respective portions of the work specified, and to so interconnect the various items or sections of the work to form a complete and properly operating whole. The work shall consist of, but shall not necessarily be limited to the following:

1. A new fire service is to be supplied to the new dorm. Provide a fully sprinklered building as noted on Fire Protection Construction drawings.

B. The following is a Summary of Contract Requirements (NOTE: This list is not all inclusive)

1. Provide new piping, sprinkler heads, supports, etc. as needed to have a fully operational sprinkler system upon project completion.
2. Provide all associated control equipment required unless otherwise noted.
3. Providing all necessary permits, approvals, fees, etc.
4. Provide painting of any exposed sprinkler piping. Coordinate with architect for color selection.
5. Provide instructions to the owner as outlined in these Specifications.
6. Provide all cutting and patching as required to perform the work of this contract.

7. Provide all necessary rigging as required to perform the work of this contract.
8. Provide manufacturer startup for all systems specified as outlined in these Specifications.
9. Provide removal of trash and general clean-up.
10. Provide as-built drawings.
11. Provide operation and maintenance manuals.
12. Completion Date: All Fire Protection work shall be completed on the date of substantial completion for the project as set in the Division 1 specifications.

C. The work shall include all materials, equipment and systems shown on the drawings and work for other Divisions required to complete all the work ready for operation.

D. The Contractor shall provide all labor, material, equipment and services for the complete and proper installation and operation of the electrical work as indicated, required or implied by the drawings and as specified herein.

E. All of the contract specifications and all of the contract drawings are part of the Contract Documents of the Contractor. The Contractor shall review all drawings and specification divisions to determine the full scope of his work.

F. It will be the responsibility of the Contractor to examine all Drawings (Architectural, Electrical Mechanical, Plumbing and Fire Protection) to determine the full extent of the work. All field measurements and verifications of conditions and materials will be the obligation of the Contractor. The submission of a Proposal by the Contractor will be considered an indication that all work, in compliance with these specifications and the drawings, has been included in the Proposal. It will also be considered an indication that a thorough review of conditions, materials, and all related specifications have been investigated by the Contractor, and the results of such investigations have been included in the Contractor's Proposal.

L. WARRANTY

1. Contractors shall note that all equipment warranties, as described in the various sections of the Specifications, will begin after Substantial Completion. It will not make any difference when equipment is ordered, delivered, or installed, warranties will commence after the Architect issues his letter of “Substantial Completion.”

2. All equipment is to include factory start-up unless the Contractor receives written permission, from the owner, for Contractor start-up. Copies of the start-up report must be included with the Request for Final Payment; otherwise, final payment will be withheld until the factory reports are submitted.

3 All equipment furnished for this Owner shall include a two-year warranty on parts and labor. This warranty shall supersede all notations in all the other Division 21 specification sections.

PART 3 - EXECUTION

3.1 “FIRE WATCH” SCOPE OF WORK

A. Personnel performing the fire watch shall NOT be performing any other duties that would take their attention away from the areas that are not covered by the fire alarm system.

END OF SECTION 210000

SECTION 210517 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

1.1 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

1.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. Metraflex Company (The).
3. Pipeline Seal and Insulator, Inc.
4. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

1.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non-shrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

2. Interior Partitions:

   a. Piping Smaller Than NPS 4: Galvanized-steel-pipe sleeves.

END OF SECTION 210517

SECTION 210518 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.

c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast- brass type with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 210518

SECTION 210553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
5. Fasteners: Stainless-steel self-tapping screws.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch .

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to [partially cover] [cover full] circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 LABEL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install or permanently fasten labels on each major item of mechanical equipment.

D. Locate equipment labels where accessible and visible.

E. Piping: Painting of piping is specified in Section 099123 "Interior Painting."

F. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where the flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 5 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

END OF SECTION 210553

SECTION 211100 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fire-suppression water-service piping modifications to include removal of the existing fire pump, installation of a new fire pump and associated equipment and electrical gear, new piping, and related components inside the building.

B. Related Sections:

1. Division 21 Section "Wet-Pipe Sprinkler Systems" for wet-pipe fire-suppression sprinkler systems inside the building.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with the "Approval Guide," published by FM Global, or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

B. Grooved-End, Ductile-Iron Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Star Pipe Products.
c. Victaulic Company.

2. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
3. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gaskets suitable for water, and bolts and nuts.

C. Flanges: ASME B16.1, Class 125, cast iron.

2.2 SPECIAL PIPE FITTINGS

A. Ductile-Iron Flexible Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. EBAA Iron, Inc.
b. ROMAC Industries Inc.
c. Star Pipe Products.

2. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
3. Pressure Rating: 250 psig minimum.

2.3 JOINING MATERIALS

A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.

2.4 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cascade Waterworks Manufacturing.
b. Dresser, Inc.; Dresser Piping Specialties.
c. Ford Meter Box Company, Inc. (The); Pipe Products Division.
d. JCM Industries.
e. ROMAC Industries Inc.
f. Smith-Blair, Inc.; a Sensus company.
g. Viking Johnson.

2. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
3. Standard: AWWA C219.
4. Center-Sleeve Material: Manufacturer's standard.
5. Gasket Material: Natural or synthetic rubber.
6. Pressure Rating: 150 psig minimum.
7. Metal Component Finish: Corrosion-resistant coating or material.

2.5 GATE VALVES

A. AWWA Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Cast Iron Pipe Company; American Flow Control Division.
b. American Cast Iron Pipe Company; Waterous Company Subsidiary.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Kennedy Valve; a division of McWane, Inc.
e. Mueller Co.; Water Products Division.
f. NIBCO INC.
g. Tyler Pipe; a division of McWane, Inc.; Utilities Division.
h. U.S. Pipe.

2. Class 125, Bronze, Nonrising-Stem Gate Valves:

a. Description: Class 125, Type 1; bronze with solid wedge and malleable-iron handwheel.
b. Standard: MSS SP-80.
c. Pressure Rating: 200 psig (1380 kPa).
d. End Connections: Solder joint or threaded.

B. UL-Listed or FM-Approved Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.; Crane Valve Group; Jenkins Valves.
    b. Crane Co.; Crane Valve Group; Stockham Division.
    c. Hammond Valve.
    d. Kennedy Valve; a division of McWane, Inc.
    e. Milwaukee Valve Company.
    f. Mueller Co.; Water Products Division.
    g. NIBCO INC.
    h. Tyco Fire & Building Products LP.
    i. U.S. Pipe.
    j. Watts Water Technologies, Inc.

2. UL-Listed or FM-Approved, OS&Y Bronze, Gate Valves:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following include:

        1) Crane Co.; Crane Valve Group; Crane Valves.
        2) Crane Co.; Crane Valve Group; Stockham Division.
        3) Milwaukee Valve Company.
        4) NIBCO INC.

    b. Description: Bronze body and bonnet and bronze stem.
    c. Standards: UL 262 and "Approval Guide," published by FM Global, listing.
    d. Pressure Rating: 175 psig (1200 kPa) minimum.
    e. End Connections: Threaded.

2.6 FIRE-DEPARTMENT CONNECTIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Elkhart Brass Mfg. Company, Inc.
2. Guardian Fire Equipment, Inc.
3. Kidde Fire Fighting.
4. Potter Roemer.
5. Reliable Automatic Sprinkler Co., Inc.

B. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire-department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high brass sleeve; and round escutcheon plate.

C. Standard: UL 405.

D. Connections: Two NPS 2-1/2 inlets and one NPS 4 outlet.

E. Inlet Alignment: Inline, horizontal.

F. Finish Including Sleeve: Polished chrome plated

G. Escutcheon Plate Marking: "AUTO SPKR & STANDPIPE."

2.7 ALARM DEVICES

A. General: UL 753 and "Approval Guide," published by FM Global, listing, of types and sizes to mate and match piping and equipment.

B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with two single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.

C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Comply with NFPA 24 for fire-service-main piping materials and installation.

B. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

C. Comply with requirements in Division 21 Sections for fire-suppression-water piping inside the building.

D. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 21 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."

3.2 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in tubing NPS 2 and smaller.

C. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of tubes and remove burrs.

E. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.

F. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

G. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.

H. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.

I. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.3 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.

3.4 VALVE INSTALLATION

A. UL-Listed or FM-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

B. MSS Valves: Install as component of connected piping system.

3.5 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire-department connection to mains.

3.6 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision.

B. Supervisory Switches: Supervise valves in open position.

1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.

C. Locking and Sealing: Secure unsupervised valves as follows:

1. Valves: Install chain and padlock on open OS&Y gate valve.
2. Post Indicators: Install padlock on wrench on indicator post.

D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and

vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

F. Connect alarm devices to building's fire-alarm system.

3.7 CONNECTIONS

A. Connect fire-suppression water-service piping to interior fire-suppression piping.

3.8 FIELD QUALITY CONTROL

A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.

B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to 0 psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

D. Prepare test and inspection reports.

3.9 IDENTIFICATION

A. Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.10 CLEANING

A. Clean fire-suppression water-service piping as follows:

1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

B. Prepare reports of purging activities.

END OF SECTION 211100

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

1.2 SYSTEM DESCRIPTIONS AND REQUIREMENTS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. System hose connections are included if indicated.

B. All concealed sprinkler heads caps shall be a specific color as chosen by the Architect.

1.3 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

B. The sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

    a. Building Service Areas: Ordinary Hazard, Group 1.
    b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
    c. General Storage Areas: Ordinary Hazard, Group 1.
    d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
    e. Office and Public Areas: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:

    a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
    b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.

4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Maximum Protection Area per Sprinkler:

    a. Office Spaces: 225 sq. ft.
    b. Storage Areas: 130 sq. ft.

c. Mechanical Equipment Rooms: 130 sq. ft.
d. Electrical Equipment Rooms: 130 sq. ft.
e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Qualification Data: For qualified Installer and professional engineer.

E. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Field quality-control reports.

H. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Standard Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 10, Grooved End Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 with factory or field formed, roll grooved ends.

C. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

D. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

E. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Corcoran Piping System Co.
c. National Fittings, Inc.
d. Tyco Fire & Building Products LP.
e. Victaulic Company.

2. Pressure Rating: 175 psig minimum.
3. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

F. Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Victaulic Company.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick.
1. Class 125, Cast-Iron Flat-Face Flanges: Full-face gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating: 175 psig.

B. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Metraflex, Inc.
d. NIBCO INC.
e. Reliable Automatic Sprinkler Co., Inc.
f. Tyco Fire & Building Products LP.
g. Victaulic Company.
h. Viking Corporation.
i. Watts Water Technologies, Inc.

2. Standard: UL 312.
3. Pressure Rating: 250 psig minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

C. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
b. American Valve, Inc.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. Mueller Co.; Water Products Division.
g. NIBCO INC.
h. Tyco Fire & Building Products LP.
i. United Brass Works, Inc.
j. Watts Water Technologies, Inc.

2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

D. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

a. Anvil International, Inc.

b. Global Safety Products, Inc.
c. Kennedy Valve; a division of McWane, Inc.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Tyco Fire & Building Products LP.
g. Victaulic Company.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig minimum.
4. Valves NPS 2 and Smaller:

a. Valve Type: Ball or butterfly.
b. Body Material: Bronze.
c. End Connections: Threaded.

5. Valves NPS 2-1/2 and Larger:

a. Valve Type: Butterfly.
b. Body Material: Cast or ductile iron.
c. End Connections: Flanged, grooved, or wafer.

6. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch indicating device.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig.

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Kennedy Valve; a division of McWane, Inc.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Potter Roemer.
f. Tyco Fire & Building Products LP.
g. Victaulic Company.
h. Watts Water Technologies, Inc.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Cast or ductile iron.

4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

a. AFAC Inc.
b. Globe Fire Sprinkler Corporation.
c. Reliable Automatic Sprinkler Co., Inc.
d. Tyco Fire & Building Products LP.
e. Venus Fire Protection Ltd.
f. Victaulic Company.
g. Viking Corporation.

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

2.7 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AFAC Inc.
b. Elkhart Brass Mfg. Company, Inc.
c. GMR International Equipment Corporation.
d. Guardian Fire Equipment, Inc.
e. Potter Roemer.

2. Standard: UL 405.
3. Type: Flush, for wall mounting. To be approved by the local Fire Company.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.
9. Outlet: With pipe threads.
10. Body Style: Horizontal.

11. Number of Inlets: Two.
12. Outlet Location: Back.
13. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE."
14. Finish: Polished chrome plated.
15. Outlet Size: NPS 4 or as requested by the local Fire Company..

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International, Inc.
   b. National Fittings, Inc.
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Elkhart Brass Mfg. Company, Inc.
   b. Fire-End & Croker Corporation.
   c. Potter Roemer.

2. Standard: UL 199.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

C. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AGF Manufacturing Inc.
   b. Triple R Specialty.
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.

   e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. CECA, LLC.
   b. Corcoran Piping System Co.
   c. Merit Manufacturing; a division of Anvil International, Inc.

2. Standard: UL 1474.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

E. Flexible, Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fivalco Inc.
   b. FlexHead Industries, Inc.
   c. Gateway Tubing, Inc.

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175 psig minimum.
5. Size: Same as connected piping, for sprinkler.

2.9 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFAC Inc.
2. Globe Fire Sprinkler Corporation.
3. Reliable Automatic Sprinkler Co., Inc.
4. Tyco Fire & Building Products LP.
5. Victaulic Company.
6. Viking Corporation.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.

C. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.

3. Painted.

D. Special Coatings:

1. Wax.
2. Lead.
3. Corrosion-resistant paint.

E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Plastic, white finish, one piece, flat.
2. Sidewall Mounting: Plastic, white finish, one piece, flat.

F. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Reliable Automatic Sprinkler Co., Inc.
b. Tyco Fire & Building Products LP.
c. Victaulic Company.
d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ADT Security Services, Inc.
b. McDonnell & Miller; ITT Industries.
c. Potter Electric Signal Company.
d. System Sensor; a Honeywell company.
e. Viking Corporation.
f. Watts Industries (Canada) Inc.

2. Standard: UL 346.

3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.

7. Design Installation: Horizontal or vertical.

C. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell company.
b. Kennedy Valve; a division of McWane, Inc.
c. Potter Electric Signal Company.
d. System Sensor; a Honeywell company.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

2.11 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following::

1. AMETEK; U.S. Gauge Division.
2. Ashcroft, Inc.
3. Brecco Corporation.
4. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0 to 250 psig minimum.

E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gage: Include "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 WATER-SUPPLY CONNECTIONS

A. Connect new sprinkler piping to building's sprinkler service array. Reconfigure service as required to accommodate new wet zone(s) system.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved

working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install alarm devices in piping systems.

K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

M. Fill sprinkler system piping with water.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 21 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."

O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 21 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 21 Section "Escutcheons for Fire- Suppression Piping."

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join light wall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipes.

J. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

K. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

L. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.5 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in the center of acoustical ceiling panels.

B. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire-department connections.

B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.7 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.10 PIPING SCHEDULE

A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

B. Wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Standard-weight, black-steel pipe with cut-or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.11 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Concealed sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright sprinklers.
5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211313

SECTION 211316 - DRY-PIPE SPRINKLER SYSTEMS

1.1 SUMMARY

A. Section Includes:

1. Steel pipe and fittings.
2. Specialty valves.
3. Dry-sprinkler system nitrogen generator with purge/vent.
4. Sprinkler piping specialties.
5. Sprinklers.
6. Manual control stations.
7. Pressure gauges.

B. Related Requirements:

1. Section 211119 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.
2. Section 230523 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dry-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated Design Submittal: For dry-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems plans and sections, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinate with all building trades.

B. Qualification Data: For qualified Installer and professional engineer.

C. Design Data: Approved sprinkler piping working plans, prepared according to NFPA 13, including documented approval by authorities having jurisdiction, and including hydraulic calculations if applicable.

D. Field Test Reports:
1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire-hydrant flow test report.

E. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air or nitrogen. Opening of sprinklers releases compressed air or nitrogen and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Sprinkler system equipment, specialties, accessories, installation, and testing to comply with NFPA 13.

C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

D. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design dry-pipe sprinkler systems.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

a. Educational: Light Hazard Group 1.
b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
c. Elevator Machine Room and Hoistway: Ordinary Hazard, Group 1

d. General Storage Areas: Ordinary Hazard, Group 1.
e. Institutional: Light Hazard, Group 1.
f. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.

g. Offices, including Data Processing: Light Hazard, Group 1.

3. Minimum Density for Automatic-Sprinkler Piping Design:

a. Light-Hazard Occupancy: 0.10 gpm/sq. ft. over 1500 sq. ft. area.
b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm/sq. ft. over 1500 sq. ft. area.
c. Light-Hazard, Group 1 Occupancy: 0.10 gpm/sq. ft. over 1500 sq. ft. area.

4. Maximum protection area per sprinkler according to UL listing.
5. Maximum Protection Area per Sprinkler:

a. Office Spaces: 225 sq. ft.
b. Storage Areas: 130 sq. ft.
c. Mechanical Equipment Rooms: 130 sq. ft.
d. Electrical Equipment Rooms: 130 sq. ft.
e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:

a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

E. Obtain documented approval of sprinkler system design from authorities having jurisdiction.

F. Seismic Performance: Sprinkler piping to withstand the effects of earthquake motions determined according to NFPA 13. See Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

2.3 STEEL PIPE AND FITTINGS

A. Standard-Weight, Galvanized-Steel Pipe: ASTM A53/A53M, [Type E], Pipe ends may be factory or field formed to match joining method.

B. Schedule 10, Galvanized-Steel Pipe: ASTM A135/A135M; ASTM A795/A795M; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 10 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Thin wall Galvanized-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

D. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.

E. Galvanized-Steel Couplings: ASTM A865/A865M, threaded.

F. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anvil International, Inc.
2. Corcoran Piping System Co.
3. National Fittings, Inc.
4. Tyco Fire & Building Products LP.
5. Victaulic Company

2. Pressure Rating: [**175-psig (1200-kPa)**] [**250-psig (1725-kPa)**] [**300-psig (2070-kPa)**] minimum.

3. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
5. Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.
6. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Victaulic Company.
   b. NIBCO

2.4 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Specialty Valves Pressure Rating: 175-psig (1200-kPa) minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Dry-Pipe Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Viking Corporation.
   2. Tyco Fire & Building Products LP.
   3. Reliable Automatic Sprinkler Co., Inc
   4. Victualic Company.

2. Standard: UL 260.
3. Design: Differential-pressure type.

4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

5. Air Compressor:

   a. Gast Manufacturing Inc.
   b. General Air Products, Inc,

c. Viking Corporation.

6. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
   a. Motor Horsepower: Fractional.

      1) Power: 120-V ac, 60 Hz, single phase.

G. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.
2. Pressure Rating: 175-psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

2.5 SPRINKLER PIPING SPECIALTIES

A. General Requirements for Dry-Pipe System Fittings: UL listed for dry-pipe service.

B. Branch Outlet Fittings:

1. Manufacturer:
   a. Anvil International, Inc.
   b. National Fittings, Inc.
   c. Shurjoint Piping Products.
   d. Tyco Fire & Building Products LP.
   e. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Dimensions to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

C. Flow Detection and Test Assemblies:

1. Manufacturer:

   a. AGF Manufacturing Inc.
   b. Reliable Automatic Sprinkler Co., Inc.

   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D. Branch Line Testers:
1. Manufacturer:
a. Elkhart Brass Mfg. Company, Inc.
b. Fire-End & Croker Corporation.
c. Potter Roemer.

2. Standard: UL 199.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

E. Sprinkler Inspector's Test Fittings:
1. Manufacturer:
a. AGF Manufacturing Inc.
b. Triple R Specialty.
c. Tyco Fire & Building Products LP.
d. Victaulic Company.
e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

F. Adjustable Drop Nipples:

1. Manufacturers:
a. CECA, LLC.
b. Corcoran Piping System Co.
c. Merit Manufacturing; a division of Anvil International, Inc.

2. Standard: UL 1474.
3. Pressure Rating: 250-psig minimum.
4. Body Material: Steel pipe with EPDM O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

G. Flexible Sprinkler Hose Fittings:

1. Manufacturer:
a. Fivalco Inc.
b. FlexHead Industries, Inc.
c. Gateway Tubing, Inc.

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum.

5. Size: Same as connected piping, for sprinkler.

2.6 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Reliable Automatic Sprinkler Co., Inc.
2. Tyco Fire & Building Products LP.
3. Victaulic Company.
4. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global' s "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum.

F. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199
2. Residential Applications: UL 1626
3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

G. Sprinkler Finishes: Chrome plated and/or painted, as required by architect.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat or Plastic, white finish, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel or Plastic, white finish, one piece, flat.

I. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Reliable Automatic Sprinkler Co., Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
   d. Viking Corporation.
2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.7 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:
1. Standard: UL 464.
2. Type: Vibrating, metal alarm bell.
3. Size: 8-inch minimum diameter.
4. Finish: Red-enamel factory finish, suitable for outdoor use.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Pressure Switches:
1. Standard: UL 346.
2. Type: Electrically supervised water-flow switch with retard feature.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design Operation: Rising pressure signals water flow.

D. Valve Supervisory Switches:
1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location

2.8 MANUAL CONTROL STATIONS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.

B. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.9 PRESSURE GAUGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMETEK, Inc.; U.S. Gauge Division.
2. Ashcroft, Inc.
3. Brecco Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0- to 250-psig minimum.

E. Label: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gage: Include"AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

Retain this article if fire-hydrant flow test is required or if Owner has not provided flow information.

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements in Section 211100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

3.3 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water-distribution piping.

3.4 INSTALLATION OF PIPING

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and

equipment having NPS 2-1/2 and larger end connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install automatic (ball drip) drain valves to drain piping between fire department connections and check valves. Drain to floor drain or to outside building.

J. Connect compressed-air supply to dry-pipe sprinkler piping.

K. Connect air compressor to the following piping and wiring:

1. Pressure gauges and controls.
2. Electrical power system.
3. Fire-alarm devices, including low-pressure alarm.

L. Install alarm devices in piping systems.

M. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

N. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft- metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal and install where they are not subject to freezing.

O. Drain dry-pipe sprinkler piping.

P. Pressurize and check dry-pipe sprinkler system piping and air compressors.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire- Suppression Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.5 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.6 INSTALLATION OF VALVES AND SPECIALTIES

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.

2. Install dry-pipe valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.

a. Install air compressor and compressed-air-supply piping.
b. Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.

c. Install compressed-air-supply piping from building's compressed-air piping system.

3.7 INSTALLATION OF SPRINKLERS

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install sprinklers with water supply from heated space. Do not install pendant or sidewall, sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.8 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative]:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire department equipment.

B. The sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.12 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-pressure, dry-pipe sprinkler system, NPS 2 and smaller to be one of the following:

1. Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

D. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:
1. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

E. Standard-pressure, dry-pipe sprinkler system, NPS 5 and NPS 6, shall be the following:
1. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.13 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Dry concealed sprinklers.
3. Wall Mounting: Dry sidewall sprinklers.
4. Spaces Subject to Freezing: Dry pendent sprinklers.
5. Special Applications: Extended-coverage and quick-response sprinklers where indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

4. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211316

SECTION 213113 – ELECTRIC DRIVE, CENTRIFUGAL FIRE PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. End-suction fire pumps.
2. In-line fire pumps.
3. Horizontally mounted, single-stage, split-case fire pumps.
4. Horizontally mounted, multistage, split-case fire pumps.
5. Vertically mounted, single-stage, split-case fire pumps.
6. Fire-pump accessories and specialties.
7. Flowmeter systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of fire pump, from manufacturer.

C. Source quality-control reports.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Fire pumps to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 20.

B. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig minimum unless higher pressure rating is indicated.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 GENERAL REQUIREMENTS FOR CENTRIFUGAL FIRE PUMPS

A. Description: Factory-assembled and -tested fire-pump and driver unit.

B. Base: Fabricated and attached to fire-pump and driver unit, with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.

C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

2.3 IN-LINE FIRE PUMPS

A. Pump:

1. Standard: UL 448 , for in-line pumps for fire service.
2. Casing: Radially split case, cast iron, with ASME B16.1 pipe-flange connections.
3. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
4. Wear Rings: Replaceable bronze.
5. Shaft and Sleeve: Steel shaft with bronze sleeve.

    a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
    b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.

6. Mounting: Pump and driver shaft is vertical, with motor above pump and pump on base. Motor and pump rotating assembly shall be removable from top without removing the pump casing from the piping.

B. Coupling: None or rigid.

C. Driver:

1. Standard: UL 1004A.
2. Type: Electric motor; NEMA MG 1, polyphase Design B.

2.4 FIRE-PUMP ACCESSORIES AND SPECIALTIES

A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.

B. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.

C. Relief Valves:
1. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.

D. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.

E. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.

F. Hose Valve Manifold Assembly:

1. Standard: Comply with requirements in NFPA 20.
2. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel, with ends threaded according to ASME B1.20.1.
3. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
4. Automatic Drain Valve: UL 1726.
5. Manifold:

a. Test Connections: Comply with UL 405; however, provide outlets without clappers instead of inlets.
b. Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
c. Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe, with ends threaded according to ASME B1.20.1.
d. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
e. Escutcheon Plate: Brass or bronze; rectangular.
f. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
g. Exposed Parts Finish: brass, chrome plated.
h. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

6. Manifold:

a. Test Connections: Comply with UL 405; however, provide outlets without clappers instead of inlets.
b. Body: Exposed type, brass, with number of outlets required by NFPA 20.
c. Escutcheon Plate: Brass or bronze; round.

d. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
e. Exposed Parts Finish: [Polished] [Rough] [brass] [, chrome plated].
f. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

2.5 GROUT

A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non-shrink and recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 SOURCE QUALITY CONTROL

A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."

1. Verification of Performance: Rate fire pumps according to UL 448.

B. Fire pumps will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of fire pumps.

B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.

B. Equipment Mounting:

1. Install fire pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
3. Comply with requirements for vibration isolation devices specified in Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment."

C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.

D. Support piping and pumps separately, so weight of piping does not rest on pumps.

E. Install valves that are same size as connecting piping.

F. Install pressure gages on fire-pump suction and discharge flange pressure-gage tapping.

G. Install piping hangers and supports, anchors, valves, gages, and all equipment supports according to NFPA 20.

H. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.

I. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.

J. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

3.3 ALIGNMENT

A. Align end-suction and split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.

B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.

C. Align piping connections.

D. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and tolerances specified by manufacturer.

3.4 CONNECTIONS

A. Comply with requirements for piping and valves specified in Section 211313 "Wet-Pipe Sprinkler Systems." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps and equipment to allow service and maintenance.

C. Connect relief-valve discharge to drainage piping or point of discharge.

D. Connect flowmeter-system meters, sensors, and valves to tubing.

E. Connect fire pumps to their controllers.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.6 FIELD QUALITY CONTROL

A. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in Section 262933 "Controllers for Fire-Pump Drivers."

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. After installing components, assemblies, and equipment, including controller, test for compliance with requirements.
2. Test according to NFPA 20 for acceptance and performance testing.
3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

F. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup check according to manufacturer's written instructions.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 213113

SECTION 213413 - PRESSURE-MAINTENANCE PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Vertical, multistage, pressure-maintenance pumps.
2. Regenerative-turbine, pressure-maintenance pumps.
3. Submersible, pressure-maintenance pumps.
4. Vertical-turbine, pressure-maintenance pumps.

B. Related Requirements:

1. Section 262933 "Controllers for Fire-Pump Drivers" for pressure-maintenance-pump controllers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For pumps, accessories, and specialties.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps to include in operation and maintenance manuals.

PART 2 – PRODUCTS

2.1 VERTICAL, MULTISTAGE, PRESSURE-MAINTENANCE PUMPS

A. Description: Factory-assembled and -tested, multistage, barrel-type vertical pump as defined in HI 2.1-2.2 and HI 2.3; designed for surface installation with pump and motor direct coupled and mounted vertically.

B. Pump Construction:

1. Barrel: Stainless steel.
2. Suction and Discharge Chamber: Cast iron with flanged inlet and outlet.
3. Pump Head/Motor Mount: Cast iron.
4. Impellers: Stainless steel, balanced, and keyed to shaft.
5. Pump Shaft: Stainless steel.
6. Seal: Mechanical type with carbon rotating face and silicon-carbide stationary seat.
7. Wear Rings: Teflon.
8. Intermediate Chamber Bearings: Aluminum-oxide ceramic or bronze.
9. Chamber-Base Bearing: Tungsten carbide.
10. O-Rings: [EPDM] [NBR] [Viton].

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Motor: Single speed with permanently lubricated ball bearings and rigidly mounted to pump head. Comply with requirements in Section 210513 "Common Motor Requirements for Fire Suppression Equipment."

E. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feet long or per equipment layout.

F. Nameplate: Permanently attached to pump and indicating capacity and characteristics.

2.2 REGENERATIVE-TURBINE, PRESSURE-MAINTENANCE PUMPS

A. Description: Factory-assembled and -tested, close-coupled, single-stage, regenerative-turbine centrifugal pump as defined in HI 1.1-1.2 and HI 1.3; with pump and motor mounted horizontally.

B. Pump Construction:

1. Casing: Radially split, cast iron, with threaded inlet and outlet.
2. Impeller: Bronze, balanced, and keyed to shaft.
3. Pump Shaft: Stainless steel[or steel] with deflector.
4. Shaft Sleeve: Bronze.
5. Seal: Mechanical type with spring-loaded rotating head.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Motor: Single speed with permanently lubricated ball bearings. Comply with requirements in Section 210513 "Common Motor Requirements for Fire Suppression Equipment."

E. Nameplate: Permanently attached to pump and indicating capacity and characteristics.

2.3 VERTICAL-TURBINE, PRESSURE-MAINTENANCE PUMPS

A. Description: Factory-assembled and -tested, vertical, multistage, open-line-shaft turbine pump as defined in HI 2.1-2.2 and HI 2.3; with pump motor mounted above pump head.

B. Pump Construction:

1. Pump Head: Cast iron, for surface discharge, with flange except connections may be threaded in sizes in which flanges are not available.
2. Pump Head Seal: Stuffing box and stuffing.
3. Line Shaft: Stainless steel or steel, with corrosion-resistant shaft sleeves.
4. Line Shaft Bearings: Rubber sleeve, water lubricated.
5. Line Shaft: Steel.
6. Line Shaft Bearings: Corrosion resistant, oil lubricated.
7. Impeller Shaft: Monel metal or stainless steel.
8. Bowl Section: Multiple cast-iron bowls with closed-type bronze or stainless-steel impellers.
9. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel fittings, in sections 10 feet or less, with strainer of cast or fabricated bronze or stainless steel at bottom.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Motor: Single speed with permanently lubricated ball bearings. Comply with requirements in Section 210513 "Common Motor Requirements for Fire Suppression Equipment."

E. Base: Cast iron or steel with hole for electrical cable.

F. Nameplate: Permanently attached to pump and indicating capacity and characteristics.

2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 210513 "Common Motor Requirements for Fire Suppression Equipment."

1. Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. NFPA Standard: Comply with NFPA 20 for installation of pressure-maintenance pumps.

B. Equipment Mounting:

1. Install multistage and regenerative-turbine, pressure-maintenance pumps according to HI 1.4.
2. Install vertical-turbine, pressure-maintenance pumps according to HI 2.4.
3. Install isolation valves in both inlet and outlet pipes near the pump. Comply with requirements for valves specified in Section 211313 "Wet-Pipe Sprinkler Systems."

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Pressure-maintenance pumps will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 ADJUSTING

A. Lubricate pumps as recommended by manufacturer.

B. Set field-adjustable pressure-switch ranges as indicated.

END OF SECTION 213413

SECTION 213900 - CONTROLLERS FOR FIRE-PUMP DRIVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Full-service, reduced-voltage controllers rated 600 V and less.

1.3 DEFINITIONS

A. ATS: Automatic transfer switch(es).

B. ECM: Electronic control module.

C. MCCB: Molded-case circuit breaker.

D. N.O.: Normally open.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each type of product indicated. Include dimensioned plans, elevations, sections, details, and attachments to other work, including required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:

a. Each installed unit's type and details.
b. Enclosure types and details for types other than NEMA 250, Type 2.
c. Factory-installed devices.
d. Nameplate legends.
e. Short-circuit current (withstand) rating of integrated unit.
f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices.
g. Specified modifications.

2. Detail equipment assemblies and indicate dimensions, weights, loads, method of field assembly, components, and location and size of each field connection.

3. Schematic and Connection Diagrams: For power, signal, alarm, and control wiring and

for pressure-sensing tubing.

C. Qualification Data: For qualified testing agency.

D. Product Certificates: For each type of product indicated, from manufacturer.

E. Manufacturer's factory test reports of fully assembled and tested equipment.

F. Source quality-control reports.

G. Field quality-control reports.

H. Operation and Maintenance Data: For each type of product indicated to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
2. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor-based logic controls.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of an NRTL.

B. Source Limitations: Obtain fire-pump controllers and all associated equipment from single source or producer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with standards of authorities having jurisdiction pertaining to materials and installation.

E. Comply with NFPA 20 and NFPA 70.

F. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:

1. Ambient Temperature Rating: Not less than 40 deg F and not exceeding 122 deg F unless otherwise indicated.

2. Altitude Rating: Not exceeding 6600 feet unless otherwise indicated.

B. Interruption of Existing Electric Service: Notify Owner no fewer than seven days in advance of proposed interruption of electric service, and comply with NFPA 70E.

1.8 COORDINATION

A. Coordinate layout and installation of controllers with other construction including conduit, piping, fire-pump equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels. Ensure that controllers are within sight of fire-pump drivers.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Indicating Lights: Two of each type and color of lens installed; two of each type and size of lamp installed.
2. Auxiliary Contacts: One for each size and type of magnetic contactor installed.
3. Power Contacts: Three for each size and type of magnetic contactor installed.
4. Contactor Coils: One for each size and type of magnetic controller installed.
5. Relay Boards: One for each size and type of relay board installed.
6. Operator Interface: One microprocessor board(s), complete with display and membrane keypad.

PART 2 - PRODUCTS

2.1 FULL-SERVICE CONTROLLERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Aquarius Fluid Products, Inc.
2. ASCO Power Technologies, LP; Firetrol Products (basis of design).
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Hubbell Incorporated; Hubbell Industrial Controls.
5. Joslyn Clark Corporation.
6. Master Control Systems, Inc.
7. Metron, Inc.
8. Tornatech.

B. General Requirements for Full-Service Controllers:

1. Comply with NFPA 20 and UL 218.
2. Listed by an NRTL for electric-motor driver for fire-pump service.

3. Combined automatic and nonautomatic operation.
4. Factory assembled, wired, and tested; continuous-duty rated.
5. Service Equipment Label: NRTL labeled for use as service equipment.

C. Method of Starting:
   1. Solid-State Controller: Reduced-voltage type.

D. Method of Stopping: Nonautomatic.

E. Capacity: Rated for fire-pump-driver horsepower and short-circuit-current (withstand) rating equal to or greater than short-circuit current available at controller location.

F. Method of Isolation and Overcurrent Protection: Interlocked isolating switch and nonthermal MCCB; with a common, externally mounted operating handle, and providing locked-rotor protection.

G. Door-Mounted Operator Interface and Controls:

   1. Monitor, display, and control the devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used.
   2. Method of Control and Indication:

      a. Microprocessor-based logic controller, with multiline digital readout.

   3. Local and Remote Alarm and Status Indications:

      a. Controller power on.
      b. Motor running condition.
      c. Loss-of-line power.
      d. Line-power phase reversal.
      e. Line-power single-phase condition.

   4. Audible alarm, with silence push button.
   5. Nonautomatic START and STOP push buttons or switches.
   6. Provide contacts for fire alarm system to tie in addressable modules to monitor the status.

H. Optional Features:

   1. Extra Output Contacts:

      a. One N.O. contact for motor running condition.
      b. One set of contacts for loss-of-line power.
      c. One each, Form C contacts for high and low reservoir level.

   2. Local alarm bell.
   3. Door-mounted thermal or impact printer for alarm and status logs.
   4. Operator Interface Communications Ports: USB, Ethernet, and RS485.

I. ATS:

   1. Complies with NFPA 20, UL 218, and UL 1008.
   2. Integral with controller as a listed combination fire-pump controller and power transfer switch.

3.

4. Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure.
5. Allows manual transfer from one source to the other.
6. Alternate-Source Isolating and Disconnecting Means: Integral molded-case switch, with an externally mounted operating handle.
7. Alternate-Source Isolating and Disconnecting Means: Mechanically interlocked isolation switch and circuit breaker rated at a minimum of 115 percent of rated motor full-load current, with an externally mounted operating handle; circuit breaker shall be provided with nonthermal sensing, instantaneous-only short-circuit overcurrent protection to comply with available fault currents.
8. Local and Remote Alarm and Status Indications:

    a. Normal source available.
    b. Alternate source available.
    c. In normal position.
    d. In alternate position.
    e. Isolating means open.

9. Audible alarm, with silence push button.
10. Nonautomatic (manual, nonelectric) means of transfer.
11. Provide contacts for fire alarm system to tie in addressable modules to monitor the status.
12. Engine test push button.
13. Start generator output contacts.
14. Timer for weekly generator tests.

2.2 ENCLOSURES

A. Fire-Pump Controllers, ATS, Remote Alarm Panels, and Low-Suction-Shutdown Panels: NEMA 250, to comply with environmental conditions at installed locations and NFPA 20.

    1. Indoor, Dry and Clean Locations: Type 1 (IEC IP10).

B. Enclosure Color: Manufacturer's standard "fire-pump-controller red".

C. Nameplates: Comply with NFPA 20; complete with capacity, characteristics, approvals, listings, and other pertinent data.

D. Testing: Test and inspect fire-pump controllers according to requirements in NFPA 20 and UL 218.

    1. Verification of Performance: Rate controllers according to operation of functions and features specified.

E. Fire-pump controllers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

G.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive equipment, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine equipment before installation. Reject equipment that is wet or damaged by moisture or mold.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONTROLLER INSTALLATION

A. Install controllers within sight of their respective drivers.

B. Connect controllers to their dedicated pressure-sensing lines.

C. Wall-Mounting Controllers: Install controllers on walls with disconnect operating handles not higher than 79 inches above finished floor, and bottom of enclosure not less than 12 inches above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Comply with NEMA ICS 15.

3.3 POWER WIRING INSTALLATION

A. Install power wiring between controllers and their services or sources, and between controllers and their drivers. Comply with requirements in NFPA 20, NFPA 70, and Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 CONTROL AND ALARM WIRING INSTALLATION

A. Install wiring between controllers and the building's fire-alarm system.

B. Bundle, train, and support wiring in enclosures.

C. Connect remote manual and automatic activation devices where applicable.

3.5 IDENTIFICATION

A. Comply with requirements in NFPA 20 for marking fire-pump controllers.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification in NFPA 20 and as specified in Division 26 Section "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Inspect and Test Each Component:

a. Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.
b. Test insulation resistance for each element, component, connecting supply, feeder, and control circuits.
c. Test continuity of each circuit.

2. Verify and Test Each Electric-Driver Controller:

a. Verify that voltages at controller locations are within plus 10 or minus 1 percent of motor nameplate rated voltages, with motors off. If outside this range for any motor, notify Engineer before starting the motor(s).
b. Test each motor for proper phase rotation.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Field Acceptance Tests:

1. Do not begin field acceptance testing until suction piping has been flushed and hydrostatically tested and the certificate for flushing and testing has been submitted to Owner and authorities having jurisdiction.
2. Prior to starting, notify authorities having jurisdiction of the time and place of the acceptance testing.
3. Engage manufacturer's factory-authorized service representative to be present during the testing.

4. Perform field acceptance tests as outlined in NFPA 20.

F. Controllers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

A. Adjust controllers to function smoothly and as recommended by manufacturer.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, and timers.

C. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

D. Set field-adjustable pressure switches.

3.9 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controllers and to use and reprogram microprocessor-based controls within this equipment.

END OF SECTION 213900

SECTION 220000 – PLUMBING SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and other Divisions Specification Sections, apply to this Section.

1.2 WARRANTY FOR PROJECT

A. The Contractor shall provide the Owner with a 2-year warranty on all materials, labor and systems from the date of Final Payment by the Owner.

1.3 DEFINITIONS

A. For a complete list of definitions for this contract refer to the Division 1 specifications.

B. Provide: Means to provide, install and make the equipment/system completely functional and operational with testing, commissioning and training.

C. Install: Means to provide, install and make the equipment/system completely functional and operational with testing, commissioning and training.

1.4 SCOPE OF WORK

A. The following description of work will use the following abbreviations:

1. General Contractor – GC
2. Electrical Contractor – EC
3. Mechanical Contractor (HVAC) – MC
4. Plumbing Contractor – PC

B. Work Included: It is the intent of these specifications and the accompanying drawings that the Contractor shall, unless otherwise specified herein, furnish all labor, materials, tools, and equipment necessary, together with the necessary accessories to constitute a satisfactory and complete installation, to complete the installation of the mechanical work, as indicated on the drawings and described hereinafter. The Contractor shall properly install, equip, adjust and put in perfect condition, the respective portions of the work specified, and to so interconnect the various items or sections of the work to form a complete and properly operating whole. The work shall consist of, but shall not necessarily be limited to the following:

1. Provide and install plumbing fixtures and new piping to plumbing fixtures including associated hangers, supports, fittings, valves and insulation as indicated on drawings and in specification sections.
2. Providing all necessary permits, approvals, fees, etc.
3. Provide instructions to the owner as outlined in these Specifications.
4. Provide all cutting and patching as required to perform the work of this contract.
5. Provide all necessary rigging as required to perform the work of this contract.
6. Provide manufacturer startup for all systems specified as outlined in these Specifications.
7. Provide removal of trash and general clean-up.

8. Provide as-built drawings.
9. Provide operation and maintenance manuals.
10. Employ the services of the local Underwriters' Inspection Agency and pay for all associated fees.
11. Completion Date: All plumbing work shall be completed on the date of substantial completion for the project as set in the Division 1 specifications.

C. The work shall include all materials, equipment and systems shown on the drawings and work for other Divisions required to complete all the work ready for operation.

D. The Contractor shall provide all labor, material, equipment and services for the complete and proper installation and operation of the electrical work as indicated, required or implied by the drawings and as specified herein.

E. All of the specifications listed and all of the drawings listed are part of the Contract Documents of the Contractor. The Contractor shall review all drawings and specification divisions to determine the full scope of his work.

F. It will be the responsibility of the Contractor to examine all Drawings (Architectural, Structural, Mechanical, Electrical and Plumbing) to determine the full extent of the work. All field measurements and verifications of conditions and materials will be the obligation of the Contractor. The submission of a Proposal by the Contractor will be considered an indication that all work, in compliance with these specifications and the drawings, has been included in the Proposal. It will also be considered an indication that a thorough review of conditions, materials, and all related specifications have been investigated by the Contractor, and the results of such investigations have been included in the Contractor's Proposal.

1.1 WARRANTY

A. Contractors shall note that all equipment warranties, as described in the various sections of the Specifications, will begin after Final Payment. It will not make any difference when equipment is ordered, delivered or installed, warranties will commence after Final Payment has been made.

B. All equipment is to include factory start-up unless the Contractor receives written permission, from the owner, for Contractor start-up. Copies of the start-up report must be included with the Request for Final Payment, otherwise final payment will be withheld until the factory reports are submitted.

C. All equipment furnished for this Owner shall include a two-year warranty on parts and labor. This warranty shall supersede all notations in all the other Division 22 specification sections.

PART 2 - PRODUCTS (Not applicable).

PART 3 - EXECUTION (Not applicable).

END OF SECTION 22000

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Plumbing demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

D. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PVC: Polyvinyl chloride plastic.

E. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.1 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

1.2 QUALITY ASSURANCE

A. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.4 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Available Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Co. of America.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

D. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

E. PVC Pipe: ASTM D 1785, Schedule 40.

F. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome plated.

C. One-Piece, Floor-Plate Type: Cast-iron floor plate.

D. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.8 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type with spring clips.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
   g. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
   h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw or spring clips.
   j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
   k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
   l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

2. Existing Piping: Use the following:

   a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.

g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying

piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 220500

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal fittings.
4. Grout.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07 Section "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for

sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6 Galvanized-steel-pipe sleeves.

4. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New & Existing Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass finish.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. RS: Rising stem.

F. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

A. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.1 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.
4. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

F. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Hammond Valve.
d. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Regular.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace them with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball valves.
2. Throttling Service: Ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Two-piece, bronze ball valves with full port and stainless-steel trim.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.
4. Pipe positioning systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
3. ASME Boiler and Pressure Vessel Code : Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. B-Line Systems, Inc.; a division of Cooper Industries.
3. ERICO/Michigan Hanger Co.
4. Grinnell Corp.
5. GS Metals Corp.
6. National Pipe Hanger Corporation.
7. PHD Manufacturing, Inc.
8. PHS Industries, Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Available Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.

b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
3. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 6, to allow off-center closure for hanger installation before pipe erection.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 6.

5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 6.
6. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 6, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
7. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 6, from single rod if horizontal movement caused by expansion and contraction might occur.
8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 6, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
9. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 6, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
10. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 6, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 6.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 6, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

10. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
11. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
14. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fastener or mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.2 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.3 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Water Piping:

a. Background Color: Green.
b. Letter Color: White.

2. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Black.
b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Cold Water: 1-1/2 inches round.
b. Hot Water: 1-1/2 inches round.

2. Valve-Tag Color:

a. Cold Water: Natural.
b. Hot Water: Natural.

3. Letter Color:

a. Cold Water: White.
b. Hot Water: White.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Mineral fiber.

2. Insulating cement.
3. Tapes.
4. Securements.
5. Corner angles.

1.1 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
3. Detail removable insulation at piping specialties, equipment connections, and access panels.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Sample Sizes:

a. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
b. Sheet Form Insulation Materials: 12 inches square.
c. Jacket Materials for Pipe: 12 inches long by NPS 2.
d. Sheet Jacket Materials: 12 inches square.
e. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

D. Qualification Data: For qualified Installer.

E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

F. Field quality-control reports.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field- applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000(Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-76.
    b. Foster Products Corporation, H. B. Fuller Company; 30-45.
    c. Marathon Industries, Inc.; 405.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. Pittsburgh Corning Corporation; Pittseal 444.
    f. Vimasco Corporation; 750.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    b. Compac Corp.; 104 and 105.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    b. Compac Corp.; 130.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
    d. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.5 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
2) GEMCO; Press and Peel.
3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. C & F Wire.

b. Childers Products.
c. PABCO Metals Corporation.
d. RPR Products, Inc.

2.6 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Testing agency labels and stamps.
2. Nameplates and data plates.
3. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be one of the following:

   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be the following:

   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1 and Smaller: Insulation shall be one of the following:

   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be the following:

   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:

   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Specialty valves.
2. Flexible connectors.
3. Escutcheons.
4. Sleeves and sleeve seals.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings.
3. Dielectric fittings.
4. Flexible connectors.
5. Escutcheons.
6. Sleeves and sleeve seals.
7. Water penetration systems.

B. Water Samples: Specified in "Cleaning" Article.

C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Domestic water piping.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than five days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Owner's written permission.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

D. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

E. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.4 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.5 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. EPCO Sales, Inc.
d. Hart Industries International, Inc.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description:

a. Pressure Rating: 150 psig at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. EPCO Sales, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Factory-fabricated, bolted, companion-flange assembly.
b. Pressure Rating: 150 psig minimum.
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Perfection Corporation; a subsidiary of American Meter Company.
b. Precision Plumbing Products, Inc.
c. Victaulic Company.

2. Description:

a. Electroplated steel nipple complying with ASTM F 1545.
b. Pressure Rating: 300 psig at 225 deg F.
c. End Connections: Male threaded or grooved.
d. Lining: Inert and noncorrosive, propylene.

2.7 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Metraflex, Inc.
4. Unaflex, Inc.
5. Universal Metal Hose; a Hyspan company

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.8 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.

C. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew or spring clips.

D. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.9 SLEEVES

A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.10 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex, Inc.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.11 GROUT

A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

E. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. Install piping adjacent to equipment and specialties to allow service and maintenance.

J. Install piping to permit valve servicing.

K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and branch connections.

N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

C. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 and Smaller: Fitting-type coupling.
2. NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.7 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
2. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.10 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetration of walls, ceilings, and floors.

B. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.

3.11 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Sleeves are not required for core-drilled holes.

C. Permanent sleeves are not required for holes formed by removable PE sleeves.

D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

E. Install sleeves in new partitions, slabs, and walls as they are built.

F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.

G. Seal space outside of sleeves in concrete slabs and walls with grout.

H. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

I. Install sleeve materials according to the following applications:

1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.

2. Sleeves for Piping Passing through Gypsum-Board Partitions:

a. Steel pipe sleeves for pipes smaller than NPS 6.
b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.

3. Sleeves for Piping Passing through Exterior Concrete Walls:

a. Steel pipe sleeves for pipes smaller than NPS 6.
b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
d. Do not use sleeves when wall penetration systems are used.

4. Sleeves for Piping Passing through Interior Concrete Walls:

a. Steel pipe sleeves for pipes smaller than NPS 6.
b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.

J. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.12 SLEEVE SEAL INSTALLATION

A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.13 WALL PENETRATION SYSTEM INSTALLATION

A. Install wall penetration systems in new, exterior concrete walls.

B. Assemble wall penetration system components with sleeve pipe. Install so that end of sleeve pipe and face of housing are flush with wall. Adjust locking devices to secure sleeve pipe in housing.

3.14 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.15 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Provide testing of domestic water system as required by Westtown Township or as indicated below, whichever is more stringent:

    a. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.16 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.17 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with use of valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush the system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.18 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

C. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.

3.19 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2-1/2 and smaller. Use butterfly valves with flanged ends for piping NPS 3 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2-1/2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 3 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Balancing valves.
2. Drain valves.
3. Water Hammer Arrestors.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. ITT Industries; Bell & Gossett Div.
c. NIBCO INC.
d. TAC Americas.
e. Taco, Inc.
f. Watts Industries, Inc.; Water Products Div.

2. Type: Ball valve with two readout ports and memory setting indicator.
3. Body: Brass or bronze,
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.
b. Crane Co.; Crane Valve Group; Stockham Div.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Red-White Valve Corp.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

C. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.
b. Leonard Valve Company.
c. Powers; a Watts Industries Co.
d. Watts Industries, Inc.; Water Products Div.
e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1070, thermostatically controlled water tempering valve.
3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 110 deg F.
9. Tempered-Water Design Flow Rate: 0.5 gpm.

2.2 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.3 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide PPP SC series or an engineer approved equal.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

C. Install water control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each control valve, water pressure- reducing valve, solenoid valve, and pump.

G. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install shutoff valve on outlet if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2- by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

H. Install water hammer arresters in water piping according to PDI-WH 201.

I. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Calibrated balancing valves.
2. Supply-type, trap-seal primer valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principal backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

SECTION 221123 – FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Grout.
7. Welding Criteria and Testing

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressures within Buildings: Pressure is 2 psig (regulated as required at equipment).

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.1 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Dielectric fittings.
6. Mechanical sleeve seals.
7. Welding certificates.

B. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

D. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

E. Qualification Data: For qualified professional engineer.

F. Welding certificates.

G. Field quality-control reports.

H. Operation and Maintenance Data: For motorized gas valves and pressure regulators to include in emergency, operation, and maintenance manuals.

1.2 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.3 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility for area where Project is located. Coordinate with utility to perform the work at the gas assembly to occur at the same time to minimize the down time for the Owner.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Owner's written permission.
3. Interruption of natural-gas service shall only be for indicated length of time indicated by the Owner and these contract documents.

1.4 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Lee Brass Company.
   b. McDonald, A. Y. Mfg. Co.
   c. Or approved equal.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Sensus
b. Fisher Control Valves and Regulators; Division of Emerson Process Management.
c. Invensys.
d. Maxitrol Company.
e. Or approved equal.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 10 psig.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Sensus.
   b. Maxitrol Company.
   c. SCP, Inc.
   d. Or approved equal.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 5 psig.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code and PECO requirements for installation and purging of natural-gas piping.

B. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.

C. Install fittings for changes in direction and branch connections.

3.4 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code and PECO requirements for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Prohibited Locations:

a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

A. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

B. Install piping adjacent to appliances to allow service and maintenance of appliances.

C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Division 22 Section "Mechanical Identification" for piping and valve identification.

3.10 PAINTING

A. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel (semigloss).
d. Color: Gray.

B. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI INT 5.1E.

a. Prime Coat: Quick-drying alkyd metal primer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd (semigloss).
d. Color: Gray.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 PIPING SCHEDULE

A. Aboveground, branch piping NPS 2 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping NPS 2-1/2 and larger shall be one of the following:

1. Steel pipe with wrought-steel fittings and welded joints.

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. Bronze plug valve.

B. Valves in branch piping for single appliance shall be the following:

1. Bronze plug valve.

END OF SECTION 221123

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene rubber.

D. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.1 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.

C. Field quality-control inspection and test reports.

1.2 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

a. Available Manufacturers:

1) ANACO.
2) Fernco, Inc.
3) Ideal Div.; Stant Corp.
4) Mission Rubber Co.

5) Tyler Pipe; Soil Pipe Div.
6) Or approved equal.

2.5 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent, Schedule 40.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings standard, shielded, stainless-steel couplings; and hubless-coupling joints.

C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

D. Underground, soil, waste, and vent piping NPS 6 and smaller shall be any of the following:

1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe Material Couplings: Shielded, non-pressure pipe couplings for joining dissimilar pipe materials with small differences in OD.

3.3 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

F. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4: 60 inches with 5/8-inch rod.

E. Install supports for vertical cast-iron soil piping every 15 feet.

F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sewage Pumps: To sewage pump discharge.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor Drains
3. Through-penetration firestop assemblies.
4. Miscellaneous sanitary drainage piping specialties.
5. Flashing materials.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.1 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.2 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Josam Company; Josam Div.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Tyler Pipe; Wade Div.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Josam Company; Josam Div.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Tyler Pipe; Wade Div.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule cleanout.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Spigot.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.

11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Watts Drainage Products Inc.
    d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Jay R. Smith as scheduled or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Light Commercial Operation.
    f. Or approved equal.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Cast Iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Not required.

11. Sediment Bucket: Not required.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Nickel bronze.
14. Top Shape: Round.
15. Dimensions of Top or Strainer: 5 inch diameter.
16. Top Loading Classification: Light Duty.
17. Funnel: Not required.
18. Inlet Fitting: Not required.
19. Trap Material: Cast iron.
20. Trap Pattern: Deep Seal P-trap.
21. Trap Features: Pro-Set Trap Guard.

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies <Insert drawing designation if any>:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.4 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft.
2. Vent Pipe Flashing: 8 oz./sq. ft.

C. Fasteners: Metal compatible with material and substrate being fastened.

D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

E. Solder: ASTM B 32, lead-free alloy.

F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.5 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.

F. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

G. Assemble open drain fittings and install with top of hub 1 inch above floor.

H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

I. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

J. Install wood-blocking reinforcement for wall-mounting-type specialties.

K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

L. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

2.6 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

2.7 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

2.8 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

2.9 PROTECTION

A. Protect drains during the remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22131

SECTION 224000 – PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets lavatories.
2. Laminar-flow faucet-spout outlets.
3. Toilet seats.
4. Fixture supports.
5. Water closets.
6. Lavatories.
7. Mop Receptors.

B. Related Sections include the following:

1. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

D. PVC: Polyvinyl chloride plastic.

E. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Plastic Mop-Service Basins: ANSI Z124.6.
2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
3. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
4. Vitreous-China Fixtures: ASME A112.19.2M.
5. Water-Closet, Flushometer Tank Trim: ASSE 1037.

H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
2. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
3. Faucets: ASME A112.18.1.
4. Hose-Connection Vacuum Breakers: ASSE 1011.
5. Hose-Coupling Threads: ASME B1.20.7.
6. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
7. NSF Potable-Water Materials: NSF 61.
8. Pipe Threads: ASME B1.20.1.

9. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
10. Supply Fittings: ASME A112.18.1.
11. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Manual-Operation Flushometers: ASSE 1037.
4. Plastic Tubular Fittings: ASTM F 409.
5. Brass Waste Fittings: ASME A112.18.2.
6. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Flexible Water Connectors: ASME A112.18.6.
2. Floor Drains: ASME A112.6.3.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Off-Floor Fixture Supports: ASME A112.6.1M.
6. Pipe Threads: ASME B1.20.1.
7. Plastic Toilet Seats: ANSI Z124.5.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures of unit shell.
b. Faulty operation of controls, blowers, pumps, heaters, and timers.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period for Commercial Applications: Three year(s) from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.

4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
5. Toilet Seats: Equal to 10 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.
7. Or approved equal.

B. Lavatory Supports:

1. Description: Type I, lavatory carrier with exposed arms and tie rods for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.2 WATER CLOSETS (P-1 & P-1A)

A. Water Closet:

1. Subject to compliance with requirements, provide model noted in plumbing fixture schedules or an engineer approved equal from one of the following:

a. Kohler Co.
b. TOTO USA, Inc.
c. Zurn, Inc.
d. American Standard Companies, Inc.
e. Or approved equal.

2. Description: See plans

2.3 URINALS (P-2 & P-2A)

A. Urinals:

1. Subject to compliance with requirements, provide model noted in plumbing fixture schedules or an engineer approved equal from one of the following:

a. Kohler Co.
b. TOTO USA, Inc.

c. Zurn, Inc.
d. American Standard Companies, Inc.
e. Or approved equal.

2. Description: See plans

2.4 LAVATORY (P-4)

A. Lavatory:

1. Subject to compliance with requirements, provide model noted in plumbing fixture schedules or an engineer approved equal from one of the following:

a. American Standard Companies, Inc.
b. Briggs Plumbing Products, Inc.
c. Crane Plumbing, L.L.C./Fiat Products.
d. Kohler Co.
e. Or approved equal.

2. ADA Covers: Plumberex Pro-Extreme pipe covers, complete with p-trap cover and supply and valve covers.

2.5 MOP RECEPTOR (P-5)

A. Mop Receptor:

1. Subject to compliance with requirements, provide model noted in plumbing fixture schedules or an engineer approved equal from one of the following:

a. Fiat.
b. Crane Plumbing, L.L.C./Fiat Products.
c. Florestone Products Co., Inc.
d. Precast Terrazzo Enterprises, Inc.
e. Stern-Williams Co., Inc.
f. Or approved equal.

2.6 SINK (P-6 and P-7)

A. Sinks:

1. Subject to compliance with requirements, provide model noted in plumbing fixture schedules or an engineer approved equal from one of the following:

a. Elkay Manufacturing Co.
b. Just Manufacturing Company.
c. Kohler Co.
d. Or approved equal.

2. Description: See plans

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install wall-mounting fixtures with tubular waste piping attached to supports.

E. Install fixtures level and plumb according to roughing-in drawings.

F. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

G. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

H. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

I. Install toilet seats on water closets.

J. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

K. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

L. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

M. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

N. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

O. Set service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

P. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

D. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 224700 – ELECTRIC WATER COOLERS AND DRINKING FOUNTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

1. This Section includes the following water coolers and related components:

    1. Pressure water coolers.
    2. Fixture supports.

1.3 DEFINITIONS

1. Accessible Water Cooler: Fixture that can be approached and used by people with disabilities.

2. Fitting: Device that controls flow of water into or out of fixture.

3. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

1.4 SUBMITTALS

1. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.

2. Shop Drawings: Diagram power, signal, and control wiring.

3. Field quality-control test reports.

4. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act" ; and Public Law 101-336, "Americans with Disabilities Act" ; for fixtures for people with disabilities.

3. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

4. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.

5. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

6. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

1.6 EXTRA MATERIALS

1. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

    1. Filter Cartridges: Equal to 50 percent of amount installed for each type and size indicated, but no fewer than 2 of each.

1.7 WARRANTY

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of EWC that fail in materials or workmanship within specified warranty period.

    1. The cooler/bottle filling station shall come with a 1 year manufacture warranty guaranteeing the unit to be free from defects in materials and workmanship for 1 year from date of install or 18 months from date of shipment from factory, whichever occurs first.
    2. Warranty Period for Compressors: Manufacturer's standard parts and associated labor, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS (P-9)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Elkay Manufacturing Co.
    b. Halsey Taylor.
    c. Oasis Corporation.
    d. Sunroc Corp.

    2. Description: See plans

2.2 FIXTURE SUPPORTS

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    1. Josam Co.
    2. MIFAB Manufacturing, Inc.
    3. Smith, Jay R. Mfg. Co.
    4. Tyler Pipe; Wade Div.
    5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
    6. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.

    1. Type I: Hanger-type carrier with two vertical uprights.
    2. Type II: Bilevel, hanger-type carrier with three vertical uprights.
    3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

1. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.

2. Examine walls and floors for suitable conditions where fixtures are to be installed.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

1. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.

2. Use mounting frames for recessed water coolers, unless otherwise indicated.

3. Set remote water coolers on floor, unless otherwise indicated.

4. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

1. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.

2. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.

3. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.

4. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

5. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

6. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

7. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.4 CONNECTIONS

1. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

2. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

4. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

1. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.

    1. Remove and replace malfunctioning units and retest as specified above.
    2. Report test results in writing.

3.6 ADJUSTING

1. Adjust fixture flow regulators for proper flow and stream height.

2. Adjust water cooler temperature settings.

3.7 CLEANING

1. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

2. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 224700

SECTION - 230000 MECHANICAL SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and other Divisions Specification Sections, apply to this Section.

B. The requirements of all other sections of Division 23 apply to this section.

1.2 DEFINITIONS

A. Provide: Means to furnish, install and make the equipment/system completely functional and operational with testing, commissioning and training.

1.3 SUMMARY

A. Work Included: It is the intent of these specifications and the accompanying drawings that the Contractor shall, unless otherwise specified herein, furnish all labor, materials, tools, and equipment necessary to complete the installation of the work as indicated on the drawings and described hereinafter. The Contractor shall properly install, equip, adjust and put in perfect condition, the respective portions of the work specified, and to so interconnect the various items or sections of the work to form a complete and properly operating whole. The work shall consist of, but shall not necessarily be limited to the following:

1. Remove the chilled water system in its entirety including, but not limited to, chiller, chilled water supply and return piping, chilled water pumps, air separator, expansion tank, glycol feed, associated valves and fittings, wires, controls, insulation, hangers and supports.
2. Remove hot water system in its entirety, including but not limited to, boilers, boiler vents, hot water supply and return piping, hot water pumps, air separator, expansion tanks, associated valves and fittings, wires, controls, insulation, hangers and supports.
3. Remove unit ventilators & air handling units as indicated throughout building, including but not limited to, supply & return ductwork, diffusers, grilles, hot & chilled water piping, condensate drain, insulation, hangers, supports, controls and wires. Existing wall louvers to remain and be blanked off with insulated sheet metal panel.
4. Remove exhaust fans as indicated throughout building, including but not limited to, ductwork, grilles, insulation, hangers, supports, controls and wires.
5. Remove rooftop units as indicated throughout building, including but not limited to, supply & return ductwork, diffusers, grilles, hot water heating coils, insulation, hangers, supports, controls and wires. Existing wall louvers to remain and be blanked off with insulated sheet metal panel.

6. Provide and install new rooftop units & DOAS units, including but not limited to, supply & return ductwork, diffusers, grilles, gas piping, VAV boxes, insulation, hangers, supports, controls and wiring as indicated on contract drawings.
7. Provide and install new split system air handling units, including but not limited to, indoor air handling unit, outdoor condensing unit, supply, return & outdoor air ductwork, diffusers, grilles, refrigerant piping, insulation, hangers, supports, controls and wiring as indicated on contract drawings.
8. Provide and install new exhaust fans, including but not limited to, ductwork, grilles, gravity relief vents/louvers, hangers, supports, controls and wiring
9. Provide and install new VRF system, including but not limited to, indoor air handling units, outdoor heat recovery units, indoor heat recovery units, refrigerant piping, insulation, hangers, supports, controls and wiring as indicated on contract drawings.
10. Provide and install electric heat units as indicated on contract drawings.
11. Provide all duct materials and construction as outlined on drawings and within specifications.
12. Provide all pipe materials and construction as outlined on drawings and within specifications.
13. Provide testing, adjusting and balancing for all new HVAC Systems.
14. Provide new unitary controls for new HVAC equipment as outlined on drawings and within specifications and integrate existing equipment into controls as documented.
15. By law, the heating system must be operational by October 15th. If the heating system cannot be operational by October 15th, the contractor is responsible for providing temporary heating for the building.
16. Care should be taken to avoid disturbing existing equipment, piping and ductwork, etc. which are to remain.
17. Provide all work noted in all of the specifications and drawings.
18. Provide all cutting and patching as required to perform the work of this contract.
19. Provide all necessary permits and approvals.
20. Provide all necessary rigging as required to perform the work of this contract.
21. Provide operation and maintenance manuals and record as-built drawings for everything installed in this contract.
22. Provide instructions and factory authorized training to owner of all equipment provided in this contract.
23. Provide cleanup and removal of all construction debris and other trash on a daily basis.

B. Note that this Summary of Work specification is intended to help delineate work. It does not mean that this is necessarily all of the work. It is ultimately the responsibility of the Contractor and their subcontractors to look at all the Contract Documents and all field conditions to determine the full extent of work for this project.

C. The work shall include all materials, equipment and systems shown on the drawings and work for other Divisions required to complete all the work ready for operation.

D. The Contractor shall provide all labor, material, equipment and services for the complete and proper installation and operation of the work as indicated, required or implied by the drawings and as specified herein.

E. All of the specifications listed and all of the drawings listed are part of the Contract Documents of the Contractor. The Contractor shall review all drawings, other documents and specification divisions to determine the full scope of his work.

F. It will be the responsibility of the Contractor to examine all Drawings (Architectural, Stuctural, Mechanical and Electrical) and contract documents to determine the full extent of the work. All field measurements and verifications of conditions and materials will be the obligation of the

Contractor. The submission of a Proposal by the Contractor will be considered an indication that all work has been included in the Proposal. It will also be considered an indication that a thorough review of conditions, materials, and all related specifications have been investigated by the Contractor, and the results of such investigations have been included in the Contractor's Proposal.

G. Coordination between the Mechanical Contractor and Electrical Contractor:

1. The Electrical Contractor shall:

a. Receive and set the motor starters, etc. as provided by the Mechanical Contractor.
b. Provide power wiring, including final connection of same, from source to starters or contactors to motors.
c. Receive and install the wall-mounted electrical control devices, thermal switches, etc., and provide all wiring for same.
d. Provide all fused or unfused disconnect switches and circuit breakers not supplied as part of the HVAC system and as required by the National Electrical Code, or as shown on the drawings, or as specified.
e. Adjust connections to electrical motors to ensure proper rotation.
f. Provide fire alarm duct detectors and remote test stations and wire/program in the fire alarm system. Turn over the duct detector in a housing and the correctly sized air tubes to the mechanical contractor for installation on the ductwork.

2. The Mechanical Contractor will:

a. Furnish and set all motors for equipment provided as part of the HVAC contract.
b. Furnish all motor starters, variable frequency drives, contactors, pushbuttons and switches for local and remote control of HVAC equipment that is not provided by the Electrical Contractor and turn over to the Electrical Contractor for installation. Combination starters shall be furnished for individual (not attached to the equipment) and for packaged equipment regardless if specified or not in the respective sections of the specification.
c. Provide pre-wired control panels, including relays, switches, pilot lights, etc., all as shown and/or specified, complete with wiring to numbered terminal strip.
d. Furnish and install duct and pipe-mounted control devices, such as freezestats, aquastats, flow switches, etc.
e. Furnish wiring diagrams for the systems power wiring, in sufficient time to allow roughing-in of conduit in accordance with the proposed work schedule.
f. Receive the fire alarm duct detector housing and air sampling tubes from the EC and install in the ductwork. MC is required to wire from the relay base of the duct detector into the HVAC unit starter/VFD for shut-down upon detection of smoke.
g. Provide all control wiring including 120V controls, 120V power and 120/24V control power transformers as required for a complete and fully functional HVAC DDC control system.

1.5 WARRANTY

A. Contractors shall note that all equipment warranties, as described in the various sections of the Specifications, will begin after Substantial Completion. It will not make any difference when equipment is ordered, delivered or installed, warranties will commence after the Architect issues his letter of “Substantial Completion.”

B. All equipment is to include factory start-up unless the Contractor receives written permission, from the owner, for Contractor start-up. Copies of the start-up report must be included with the

Request for Final Payment, otherwise final payment will be withheld until the factory reports are submitted.

C. All equipment furnished for this Owner shall include a two-year warranty on parts and labor. This warranty shall supersede all notations in all the other Division 23 specification sections that are shorter than two years.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION (Not applicable).

END OF SECTION 230000s

SECTION 230500 – COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. HVAC demolition.
7. Equipment installation requirements common to equipment sections.
8. Painting and finishing.
9. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Mechanical sleeve seals.
3. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F 493.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Rough brass.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
g. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 230500

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements

of specific motor application:

1. Permanent-split capacitor.
2. Electronically commutated
3. Split phase.
4. Capacitor start, inductor run.
5. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, electronically commutated.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:

1. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Allied Tube and Conduit.
   b. B-line.
   c. Unistrut.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Electroplated zinc.

2.4 THERMAL-HANGER SHIELD INSERTS FOR FIBERGLASS INSULATED PIPING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. National Pipe Hanger Corporation.
   2. Pipe Shields, Inc.
   3. Piping Technology and Products, Inc.
   4. Armaflex

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 INSULATION PIPE HANGER FOR PIPING WITH FLEXIBLE ELASTOMERIC INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armaflex Armafix IPH

B. Single-piece thermally insulated pipe hanger with self-adhesive closure. CFC-free PUR/PIR load-bearing segments embedded in closed cell insulation with outer shell of 30-mil thick painted aluminum.

C. Shall be installed under all insulated lines at unistrut clamps, clevis hangers, or locations where insulation may be compressed.

D. The seams shall be sealed with Armaflex 520, 520 Black or 520 BLV contact adhesive. To minimize the movement of Armafix, it is recommended that a pair of non-skid pads be adhered to the clamps. In addition, to prevent loosening of the clamps, use of an anti-vibratory fastener, such as a nylon-locking nut, is also recommended.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.7 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert for piping with fiberglass insulation and Armafix IPH for piping with flexible elastomeric insulation.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
6. Install Armafix IPH at all hangers where flexible elastomeric is utilized for piping.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099110 "Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.

11. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
13. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
14. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
15. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
16. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
17. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
18. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
19. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
20. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 – VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Freestanding spring isolators.
4. Spring hangers.
5. Spring hangers with vertical-limit stops.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Welding certificates.

C. Qualification Data: For professional engineer and testing agency.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. California Dynamics Corporation.
3. Isolation Technology, Inc.
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibration Eliminator Co., Inc.
7. Vibration Mountings & Controls, Inc.

B. Pads: ranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

E. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

F. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic control devices for compliance with installation tolerance requirements and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VIBRATION-CONTROL DEVICE INSTALLATION

A. Install cables so they do not bend across edges of adjacent equipment or building structure.

B. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

C. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until full design strength is achieved.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to

restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator deflection.
7. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

END OF SECTION 230548

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Condensate-Water Piping:

a. Background Color: Green.
b. Letter Color: White.

2. Refrigerant Piping:

   a. Background Color: Black.
   b. Letter Color: White.

3.4 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Hot Water: 1-1/2 inches, round.
   b. Gas: 1-1/2 inches, round.

2. Valve-Tag Color:

   a. Hot Water: Natural.
   b. Gas: Natural.

3. Letter Color:

   a. Hot Water: Black.
   b. Gas: Black.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-air-volume air systems.

2. Testing, Adjusting, and Balancing Equipment:

a. Motors.
b. Air-cooled chillers.
c. Heat-transfer coils.

3. Procedures for Testing, Adjusting, and Balancing Existing Systems.
4. Controls Verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Needs for coordination and cooperation of trades and subcontractors.
d. Proposed procedures for documentation and communication flow.

1.5 ACTION SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 90 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Certified TAB reports.

F. Sample report forms.

G. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB or TABB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230700 "HVAC Insulation"

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust- air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit,

rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan- motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
   a. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.

2. Measure motor voltage and amperage. Compare the values to motor nameplate

information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.7 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

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3.8 PROCEDURES FOR WATER CHILLERS

A. Air-Cooled Chillers: Balance water flow through each evaporator to within specified tolerances of indicated flow, with all pumps operating. With only one chiller operating in a multiple-chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design

conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
3. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
4. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
5. Capacity: Calculate in tons of cooling.
6. Efficiency: Calculate operating efficiency for comparison to submitted equipment.
7. Verify condenser-fan rotation and record fan and motor data, including number of fans and entering- and leaving-air temperatures.

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, and fan-coil units.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.

3.10 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.11 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.12 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.13 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.

3.

4. Project name.
5. Project location.
6. Architect's name and address.
7. Engineer's name and address.
8. Contractor's name and address.
9. Report date.
10. Signature of TAB supervisor who certifies the report.
11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
12. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

13. Nomenclature sheets for each item of equipment.
14. Data for terminal units, including manufacturer's name, type, size, and fittings.
15. Notes to explain why certain final data in the body of reports vary from indicated values.
16. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

8.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.

i. Center-to-center dimensions of sheave and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Outdoor airflow in cfm.
i. Return airflow in cfm.
j. Outdoor-air damper position.
k. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.

i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F
k. Leaving-water temperature in deg F.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

H. System-Coil Reports: For water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.

c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water flow rate in gpm.
e. Water pressure drop in feet of head or psig.
f. Entering-air temperature in deg F.
g. Leaving-air temperature in deg F.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

K. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.

h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

L. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.15 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Engineer.

B. Engineer shall randomly select measurements, documented in the final report, to be rechecked.

Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.16 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230700 – HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Flexible elastomeric.
b. Mineral fiber.

2. Adhesives.
3. Mastics.
4. Lagging adhesives.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied jackets.
8. Tapes.
9. Securements.

B. Related Sections:

1. Division 23 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

C. Qualification Data: For qualified Installer.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory- Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

H. Mineral-Fiber, Preformed Pipe Insulation:

I.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000 Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.
    e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

3. Conductivity: 0.28 Btu*in./(h*ft2 °F)

J. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Johns Manville.
    b. Knauf Insulation.
    c. Owens Corning.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Aeroflex USA Inc.; Aeroseal.
    b. Armacell LCC; 520 Adhesive.
    c. Foster Products Corporation, H. B. Fuller Company; 85-75.
    d. RBX Corporation; Rubatex Contact Adhesive.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-82.
    b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    d. Marathon Industries, Inc.; 225.
    e. Mon-Eco Industries, Inc.; 22-25.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
d. Marathon Industries, Inc.; 550.
e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-52.
b. Foster Products Corporation, H. B. Fuller Company; 81-42.
c. Marathon Industries, Inc.; 130.
d. Mon-Eco Industries, Inc.; 11-30.
e. Vimasco Corporation; 136.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket for indoor piping: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Outdoor insulation PVC Jacket: Insulation Protector for Refrigeration Piping on Outdoor applications that complies with mandatory requirements. Engineered PVC Material is UV/Weather Resistant and a Class II Vapor Retarder. Insulation Protection System consists of an Engineered and Formulated PVC Sheeted Material to Specifically protect outdoor piping insulation, it is designed and manufactured as a flexible PVC jacket, with a permanent non- adhesive dual bonded self-gripping integral fastening system. The fastening system allows the protector to be Removable and Reusable for ease of Maintenance, as required by code bodies. The Insulation Protector consists of resilient PVC Material that is Class "A" Fire/Smoke Rated, Vapor Retarder, Anti-Fungal, and Anti-Microbial.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Airex Manufacturing, Inc.: E-Flex Guard.
    b. Childers Products, Division of ITW
    c. Foster Products Corportaion
    d. Or Approved Equal

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.

    a. Shapes: 90-degree, short- and long-radius elbows, mechanical joints.

4. Comply with ASTM E96 and ASTM G153.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    b. Compac Corp.; 104 and 105.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    b. Compac Corp.; 110 and 111.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    b. Compac Corp.; 130.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
    d. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated,

securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the following:

1) GEMCO; Nylon Hangers.
2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
2) GEMCO; Press and Peel.
3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, provide one of the following:

1) GEMCO.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire.
b. Childers Products.
c. PABCO Metals Corporation.
d. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems" for firestopping and fire-resistive joint sealers.

E. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from stainless steel, at least 0.040 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

    1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.9 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.
2. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and threelocations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

D. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

E. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in nonconditioned space.
4. Indoor, exposed return located in nonconditioned space.

5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

7. Outdoor, concealed supply and return.
8. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Round and flat-oval, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

B. Round and flat-oval, outdoor-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches thick and 0.75-lb/cu. ft. nominal density.

C. Rectangular, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

D. Rectangular, return-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

E. Rectangular, outdoor-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches thick and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

F. Return-air plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

G. Outdoor-air plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches thick and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 2 inch thick.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Outdoor Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 2” inch thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field- applied jacket over the factory-applied jacket.

B. Piping, Exposed: Outdoor insulation PVC Jacket Airex E-Flex Guard or approved equal with Airex Titan outlet TGS Series at refrigerant piping exterior wall penetrations.

END OF SECTION 230700

SECTION 230900 – INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. This Section includes control equipment for HVAC systems and components, including control components for terminal units not supplied with factory-wired controls. This Section includes the Building Management System (BMS) control equipment for HVAC systems and components, including open protocol control components for terminal heating and cooling units. It's the intent of this specification to have the controls contractor furnish an Niagara AX platform open protocol web based build automation and temperature control system for the new chiller system. Each piece of equipment will have its own application specific controller (By ATC or unit manufacturer as noted in plans and specifications and network room sensor wired to a single web accessible enterprise network controller (ENC) including new computer workstation with graphical user interface software.

1.2 DEFINITIONS

A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.

B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.

C. BACnet Specific Definitions:

1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data and services over a network.
2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
4. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.

D. Binary: Two-state signal where a high signal level represents "ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.

E. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: network controllers, programmable application controllers, and application-specific controllers.

F. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.

G. COV: Changes of value.

H. DDC System Provider: Authorized representative of, and trained by, DDC system manufacturer and responsible for execution of DDC system Work indicated.

I. Distributed Control: Processing of system data is decentralized and control decisions are made at subsystem level. System operational programs and information are provided to remote subsystems and status is reported back. On loss of communication, subsystems to be capable of operating in a standalone mode using the last best available data.

J. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.

K. HLC: Heavy load conditions.

L. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI) and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.

M. LAN: Local area network.

N. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

O. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.

P. MTBF: Mean time between failures.

Q. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.

R. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.

S. Peer to Peer: Networking architecture that treats all network stations as equal partners.

T. POT: Portable operator's terminal.

U. RAM: Random access memory.

V. RF: Radio frequency.

W. Router: Device connecting two or more networks at network layer.

X. Server: Computer used to maintain system configuration, historical and programming database.

Y. TCP/IP: Transport control protocol/Internet protocol.

Z. UPS: Uninterruptible power supply.

AA. USB: Universal Serial Bus.

BB. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.

CC. VAV: Variable air volume.

DD. WLED: White light emitting diode.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Multiple Submissions:

1. If multiple submissions are required to execute work within schedule, first submit a coordinated schedule clearly defining intent of multiple submissions. Include a proposed date of each submission with a detailed description of submittal content to be included in each submission.
2. Clearly identify each submittal requirement indicated and in which submission the information will be provided.
3. Include an updated schedule in each subsequent submission with changes highlighted to easily track the changes made to previous submitted schedule.

B. Product Data:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation, operation, and maintenance instructions including factors effecting performance.
5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.

    a. Workstations.
    b. Servers.
    c. Gateways.
    d. Routers.
    e. Protocol analyzers.
    f. DDC controllers.

g. Enclosures.
h. Electrical power devices.
i. UPS units.
j. Accessories.
k. Instruments.
l. Control dampers and actuators.
m. Control valves and actuators.

6. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.
7. Each submitted piece of product literature to clearly cross reference specification and drawings that submittal is to cover.

C. Software Submittal:

1. Cross-referenced listing of software to be loaded on each operator workstation, server, gateway, and DDC controller.
2. Description and technical data of all software provided and cross-referenced to products in which software will be installed.
3. Operating system software, operator interface and programming software, color graphic software, DDC controller software, maintenance management software, and third-party software.
4. Include a flow diagram and an outline of each subroutine that indicates each program variable name and units of measure.
5. Listing and description of each engineering equation used with reference source.
6. Listing and description of each constant used in engineering equations and a reference source to prove origin of each constant.
7. Description of operator interface to alphanumeric and graphic programming.
8. Description of each network communication protocol.
9. Description of system database, including all data included in database, database capacity, and limitations to expand database.
10. Description of each application program and device drivers to be generated, including specific information on data acquisition and control strategies showing their relationship to system timing, speed, processing burden, and system throughout.
11. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

D. Shop Drawings:

1. General Requirements:

a. Include cover drawing with Project name, location, Owner, Architect, Contractor, and issue date with each Shop Drawings submission.
b. Include a drawing index sheet listing each drawing number and title that matches information in each title block.
c. Drawings Size: 42 inch x 30 inch.

2. Include plans, elevations, sections, and mounting details where applicable.
3. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Detail means of vibration isolation and show attachments to rotating equipment.
5. Plan Drawings indicating the following:

a. Screened backgrounds of walls, structural grid lines, HVAC equipment, ductwork, and piping.
b. Room names and numbers with coordinated placement to avoid interference with control products indicated.
c. Each desktop workstation network port, server, gateway, router, DDC controller, control panel instrument connecting to DDC controller, and damper and valve connecting to DDC controller, if included in Project.
d. Exact placement of products in rooms, ducts, and piping to reflect proposed installed condition.
e. Network communication cable and raceway routing.
f. Information, drawn to scale, of 1/8":1'.
g. Proposed routing of wiring, cabling, conduit, and tubing; coordinated with building services for review before installation.

6. Schematic drawings for each controlled HVAC system indicating the following:

a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
c. A graphic showing location of control I/O in proper relationship to HVAC system.
d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.
e. Unique identification of each I/O that to be consistently used between different drawings showing same point.
f. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays, and interface to DDC controllers.
g. Narrative sequence of operation.
h. Graphic sequence of operation, showing all inputs and output logical blocks.

7. Control panel drawings indicating the following:

a. Panel dimensions, materials, size, and location of field cable, raceways, and tubing connections.
b. Interior subpanel layout, drawn to scale and showing all internal components, cabling and wiring raceways, nameplates, and allocated spare space.
c. Front, rear, and side elevations and nameplate legend.
d. Unique drawing for each panel.

8. DDC system network riser diagram indicating the following:

a. Each device connected to network with unique identification for each.
b. Interconnection of each different network in DDC system.
c. For each network, indicate communication protocol, speed and physical means of interconnecting network devices, such as copper cable type, or optical fiber cable type. Indicate raceway type and size for each.
d. Each network port for connection of an operator workstation or other type of operator interface with unique identification for each.

9. DDC system electrical power riser diagram indicating the following:

a. Each point of connection to field power with requirements (volts/phase//hertz/amperes/connection type) listed for each.

b. Each control power supply including, as applicable, transformers, power-line conditioners, transient voltage suppression and high filter noise units, DC power supplies, and UPS units with unique identification for each.
c. Each product requiring power with requirements (volts/phase//hertz/amperes/connection type) listed for each.
d. Power wiring type and size, race type, and size for each.

10. Monitoring and control signal diagrams indicating the following:

a. Control signal cable and wiring between controllers and I/O.
b. Point-to-point schematic wiring diagrams for each product.
c. Control signal tubing to sensors, switches, and transmitters.
d. Process signal tubing to sensors, switches, and transmitters.

11. Color graphics indicating the following:

a. Itemized list of color graphic displays to be provided.
b. For each display screen to be provided, a true color copy showing layout of pictures, graphics, and data displayed.
c. Intended operator access between related hierarchical display screens.

E. System Description:

1. Full description of DDC system architecture, network configuration, operator interfaces and peripherals, servers, controller types and applications, gateways, routers and other network devices, and power supplies.
2. Complete listing and description of each report, log and trend for format and timing, and events that initiate generation.
3. System and product operation under each potential failure condition including, but not limited to, the following:

a. Loss of power.
b. Loss of network communication signal.
c. Loss of controller signals to inputs and outpoints.
d. Operator workstation failure.
e. Server failure.
f. Gateway failure.
g. Network failure.
h. Controller failure.
i. Instrument failure.
j. Control damper and valve actuator failure.

4. Complete bibliography of documentation and media to be delivered to Owner.
5. Description of testing plans and procedures.
6. Description of Owner training.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

1. Plan drawings and corresponding product installation details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.

2. Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.

B. Qualification Statements:

1. Systems Provider's Qualification Data:

a. Resume of project manager assigned to Project.
b. Resumes of application engineering staff assigned to Project.
c. Resumes of installation and programming technicians assigned to Project.
d. Resumes of service technicians assigned to Project.
e. Brief description of past project including physical address, floor area, number of floors, building system cooling and heating capacity, and building's primary function.
f. Description of past project DDC system, noting similarities to Project scope and complexity indicated.
g. Names of staff assigned to past project that will also be assigned to execute work of this Project.
h. Owner contact information for past project including name, phone number, and email address.
i. Contractor contact information for past project including name, phone number, and email address.
j. Architect and Engineer contact information for past project including name, phone number, and email address.

2. Manufacturer's qualification data.
3. Testing agency's qualification data.

C. Welding certificates.

D. Product Certificates:

1. Data Communications Protocol Certificates: Certifying that each proposed DDC system component complies with ASHRAE 135.

E. Test and Evaluation Reports:

1. Product Test Reports: For each product, for tests performed by a qualified testing agency.
2. Preconstruction Test Reports: For each separate test performed.

F. Source Quality-Control Submittals:

1. Source quality-control reports.

G. Field Quality-Control Submittals:

1. Field quality-control reports.

H. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For DDC system.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
c. As-built versions of submittal Product Data.
d. Names, addresses, email addresses, and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set points and variables.
f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
g. Engineering, installation, and maintenance manuals that explain how to do the following:

1) Design and install new points, panels, and other hardware.
2) Perform preventive maintenance and calibration.
3) Debug hardware problems.
4) Repair or replace hardware.

h. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
i. Backup copy of graphic files, programs, and databases on electronic media.
j. List of recommended spare parts with part numbers and suppliers.
k. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
l. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
m. Licenses, guarantees, and warranty documents.
n. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
o. Owner training materials.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials and parts to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Include product manufacturers' recommended parts lists for proper product operation over four-year period following warranty period. Parts list to be indicated for each year.

C. Furnish parts, as indicated by manufacturer's recommended parts list, for product operation during two-year period following warranty period.

D. Furnish quantity indicated of matching product(s) in Project inventory for each unique size and type of following:

1. Network Controller: One.
2. Programmable Application Controller: One.
3. Application-Specific Controller: One.
4. General-Purpose Relay: One.
5. Multifunction Time-Delay Relay: One.
6. Latching Relay: One.
7. Current-Sensing Relay: One.
8. Combination On-Off Status Sensor and On-Off Relay: One.
9. Transformer: One.
10. DC Power Supply: One.

1.8 QUALITY ASSURANCE

A. DDC System Manufacturer Qualifications:

1. Nationally recognized manufacturer of DDC systems and products.
2. DDC systems with similar requirements to those indicated for a continuous period of five years within time of bid.
3. DDC systems and products that have been successfully tested and in use on at least five past projects.
4. Having complete published catalog literature, installation, operation, and maintenance manuals for all products intended for use.
5. Having full-time in-house employees for the following:

    a. Product research and development.
    b. Product and application engineering.
    c. Product manufacturing, testing, and quality control.
    d. Technical support for DDC system installation training, commissioning, and troubleshooting of installations.
    e. Owner operator training.

B. DDC System Provider Qualifications:

1. Authorized representative of, and trained by, DDC system manufacturer.
2. In-place facility located within 50 miles of Project.
3. Demonstrate past experience with installation of DDC system products being installed for period within five consecutive years before time of bid.
4. Demonstrate past experience on five projects of similar complexity, scope, and value.
5. Demonstrate past experience of each person assigned to Project.
6. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
7. Service and maintenance staff assigned to support Project during warranty period.
8. Product parts inventory to support ongoing DDC system operation for a period of not less than five years after Substantial Completion.
9. DDC system manufacturer's backing to take over execution of the Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

C. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

D. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.
3. AWS D1.3/D1.3M.
4. AWS D1.4/D1.4M.

E. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators in accordance with ASME Boiler and Pressure Vessel Code.

1.9 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Perform warranty service during normal business hours and commence within 8 hours of Owner's warranty service request.
2. Warranty Period: Two year(s) from date of Substantial Completion.

a. For Gateway: Two-year parts and labor warranty for each.

PART 2 - PRODUCTS

2.1 DDC SYSTEM MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Siemens (Basis of Design)
2. Automated Logic
3. Honeywell EBI

2.2 DDC SYSTEM DESCRIPTION

A. Microprocessor-based monitoring and control including analog/digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices to achieve a set of predefined conditions.

1. DDC system consisting of high-speed, peer-to-peer network of distributed DDC controllers, other network devices, operator interfaces, and software.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 PERFORMANCE REQUIREMENTS

A. ASME Compliance:

1. DDC system for monitoring and controlling of HVAC systems.

B. Delivery of selected control devices to equipment and systems manufacturers for factory installation and to HVAC systems installers for field installation.

C. Delegated Design, Qualified Professional Engineer: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design DDC system to satisfy requirements indicated.

D. Surface-Burning Characteristics: Products installed in ducts, equipment, and return-air paths complying with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

E. DDC System Speed:

1. Response Time of Connected I/O:

a. Update AI point values connected to DDC system at least every five seconds for use by DDC controllers. Points used globally to also comply with this requirement.
b. Update BI point values connected to DDC system at least every five seconds for use by DDC controllers. Points used globally to also comply with this requirement.
c. AO points connected to DDC system to begin to respond to controller output commands within two second(s). Global commands to also comply with this requirement.
d. BO point values connected to DDC system to respond to controller output commands within two second(s). Global commands to also comply with this requirement.

2. Display of Connected I/O:

a. Update and display analog point COV connected to DDC system at least every 10 seconds for use by operator.
b. Update and display binary point COV connected to DDC system at least every 10 seconds for use by operator.
c. Update and display alarms of analog and digital points connected to DDC system within 45 seconds of activation or change of state.
d. Update graphic display refresh within eight seconds.
e. Point change of values and alarms displayed from workstation to workstation when multiple operators are viewing from multiple workstations to not exceed graphic refresh rate indicated.

F. Network Bandwidth: Design each network of DDC system to include spare bandwidth with DDC system operating under normal and heavy load conditions indicated. Calculate bandwidth usage, and apply a safety factor to ensure that requirement is satisfied when subjected to testing under worst case conditions. Minimum spare bandwidth as follows:

1. Level 1 Networks: 20.

2. Level 2 Networks: 20.
3. Level 3 Networks: 10.

G. DDC System Data Storage:

1. Include capability to archive not less than 36 consecutive months of historical data for all I/O points connected to system, including alarms, event histories, transaction logs, trends, and other information indicated.
2. Local Storage:

   a. Provide server with data storage indicated. Server(s) to use IT industry standard database platforms and be capable of functions described in "DDC Data Access" Paragraph.

3. Cloud Storage:

   a. Provide application-based and web browser interfaces to configure, upload, download, and manage data and to service plan with storage adequate to store all data for term indicated. Cloud storage uses IT industry standard database platforms and is capable of functions described in "DDC Data Access" Paragraph.

H. DDC Data Access:

1. When logged into the system, operator able to also interact with any DDC controllers connected to DDC system as required for functional operation of DDC system.
2. Use for application configuration; for archiving, reporting, and trending of data; for operator transaction archiving and reporting; for network information management; for alarm annunciation; and for operator interface tasks and controls application management.

I. Future Expandability:

1. DDC system size is expandable to an ultimate capacity of at least 1.25 times total I/O points indicated.
2. Design and install system networks to achieve ultimate capacity with only addition of DDC controllers, I/O, and associated wiring and cable. Design and install initial network infrastructure to support ultimate capacity without having to remove and replace portions of network installation.
3. Operator interfaces installed initially do not require hardware and software additions and revisions for system when operating at ultimate capacity.

J. Input Point Values Displayed Accuracy: Meet following end-to-end overall system accuracy, including errors associated with meter, sensor, transmitter, lead wire or cable, and analog to digital conversion.

1. Energy:

   a. Thermal: Within 5 percent of reading.
   b. Electric Power: Within 1 percent of reading.
   c. Requirements indicated on Drawings for meters not supplied by utility.

2. Flow:

   a. Air: Within 5 percent of design flow rate.

b. Air (Terminal Units): Within 10 percent of design flow rate.
c. Natural Gas: Within 2 percent of design flow rate.
d. Water: Within 2 percent of design flow rate.

3. Gas:

a. Carbon Dioxide: Within 50 ppm.
b. Carbon Monoxide: Within 5 percent of reading.
c. Oxygen: Within 5 percent of reading.
d. Refrigerant: Within 5 percent of reading.
e. VOCs: Within 5 percent of reading.

4. Moisture (Relative Humidity):

a. Air: Within 5 percent RH.
b. Space: Within 5 percent RH.
c. Outdoor: Within 5 percent RH.

5. Level: Within 5 percent of reading.
6. Pressure:

a. Air, Ducts and Equipment: 1 percent of instrument range.
b. Space: Within 1 percent of instrument range.
c. Water: Within 1 percent of instrument range.

7. Speed: Within 10 percent of reading.
8. Temperature, Dew Point:

a. Air: Within 1 deg F.
b. Space: Within 1 deg F.
c. Outdoor: Within 3 deg F.

9. Temperature, Dry Bulb:

a. Air: Within 1 deg F.
b. Space: Within 1 deg F.
c. Outdoor: Within 3 deg F.
d. Heating Hot Water: Within 1 deg F.
e. Energy Recovery Runaround Liquid: Within 1 deg F.
f. Temperature Difference: Within 0.1 deg F.
g. Other Temperatures Not Indicated: Within 1 deg F.

10. Temperature, Wet Bulb:

a. Air: Within 1 deg F.
b. Space: Within 1 deg F.
c. Outdoor: Within 2 deg F.

11. Vibration: Within 5 percent of reading.

K. Precision of I/O Reported Values: Values reported in database and displayed to have following precision:

1. Current:

a. Milliamperes: Nearest 1/100th of a milliampere.
b. Amperes: Nearest 1/10th of an ampere up to 100 A; nearest ampere for 100 A and more.

2. Energy:

a. Electric Power:

1) Rate (Watts): Nearest 1/10th of a watt through 1000 W.
2) Rate (Kilowatts): Nearest 1/10th of a kilowatt through 1000 kW; nearest kilowatt above 1000 kW.
3) Usage (Kilowatt-Hours): Nearest kilowatt through 10,000 kW; nearest 10 kW between 10,000 and 100,000 kW; nearest 100 kW for above 100,000 kW.

b. Natural Gas (Usage): Nearest 1/10th of a unit (cubic feet, MCF, therm) up to 100 units; nearest unit for above 100 units.
c. Thermal, Rate:

1) Heating: For British thermal units per hour, nearest British thermal unit per hour up to 1000 Btu/h; nearest 10 Btu/h between 1000 and 10,000 Btu/h; nearest 100 Btu/h for above 10,000 Btu/h. For MBh, round to nearest MBh up to 1000 MBh; nearest 10 MBh between 1000 and 10,000 MBh; nearest 100 MBh above 10,000 MBh.
2) Cooling: For tons, nearest ton up to 1000 tons; nearest 10 tons between 1000 and 10,000 tons; nearest 100 tons above 10,000 tons.

d. Thermal, Usage:

1) Heating: For British thermal unit, nearest British thermal unit up to 1000 Btu; nearest 10 Btu between 1000 and 10,000 Btu; nearest 100 Btu for above 10,000 Btu. For MBtu, round to nearest MBtu up to 1000 MBtu; nearest 10 MBtu between 1000 and 10,000 MBtu; nearest 100 MBtu above 10,000 MBtu.
2) Cooling: For ton-hours, nearest ton-hours up to 1000 ton-hours; nearest 10 ton-hours between 1000 and 10,000 ton-hours; nearest 100 tons above 10,000 tons.

3. Flow:

a. Air: Nearest 1/10th of a cubic feet per minute through 100 cfm; nearest cubic feet per minute between 100 and 1000 cfm; nearest 10 cfm between 1000 and 10,000 cfm; nearest 100 cfm above 10,000 cfm.
b. Natural Gas: Nearest 1/10th of a cubic feet per hour through 100 cfh; nearest cubic feet per hour between 100 and 1000 cfh; nearest 10 cfh between 1000 and 10,000 cfh; nearest 100 cfh above 10,000 cfh.
c. Water: Nearest 1/10th of a gallon per minute through 100 gpm; nearest gallon per minute between 100 and 1000 gpm; nearest 10 gpm between 1000 and 10,000 gpm; nearest 100 gpm above 10,000 gpm.

4. Gas:

a. Carbon Dioxide (ppm): Nearest ppm.
b. Carbon Monoxide (ppm): Nearest ppm.
c. Oxygen (Percentage): Nearest 1/10th of 1 percent.
d. Refrigerant (ppm): Nearest ppm.

e. Volatile Organic Compounds (ppm): Nearest ppm

5. Moisture (Relative Humidity):

a. Relative Humidity (Percentage): Nearest 1 percent.

6. Level: Nearest 1/100th of an inch through 10 inches; nearest 1/10 of an inch between 10 and 100 inches; nearest inch above 100 inches.
7. Speed:

a. Rotation (rpm): Nearest 1 rpm.
b. Velocity: Nearest 1/10th of feet per minute through 100 fpm; nearest feet per minute between 100 and 1000 fpm; nearest 10 fpm above 1000 fpm.

8. Position, Dampers and Valves (Percentage Open): Nearest 1 percent.
9. Pressure:

a. Air, Ducts and Equipment: Nearest 1/10th of an inch water closet.
b. Space: Nearest 1/100th of an inch water closet.
c. Water: Nearest 1/10 of a pound per square inch gauge through 100 psig; nearest pound per square inch gauge above 100 psig.

10. Temperature:

a. Air, Ducts and Equipment: Nearest 1/10th of a degree.
b. Outdoor: Nearest degree.
c. Space: Nearest 1/10th of a degree.
d. Heating Hot Water: Nearest degree.
e. Heat Recovery Runaround: Nearest 1/10th of a degree.

11. Vibration: Nearest 1/10th of an inch per second.
12. Voltage: Nearest 1/10 V up to 100 V; nearest volt above 100 V.

L. Control Stability: Control variables indicated within the following limits:

1. Flow:

a. Air, Ducts and Equipment, except Terminal Units: Within 5 percent of design flow rate.
b. Air, Terminal Units: Within 10 percent of design flow rate.
c. Water: Within 2 percent of design flow rate.

2. Gas:

a. Carbon Dioxide: Within 50 ppm.
b. Carbon Monoxide: Within 5 percent of reading.
c. Oxygen: Within 5 percent of reading.

3. Moisture (Relative Humidity):

a. Air: Within 5 percent RH.
b. Space: Within 5 percent RH.
c. Outdoor: Within 5 percent RH.

4. Level: Within 5 percent of reading.
5. Pressure:

    a. Air, Ducts and Equipment: 1 percent of instrument range.
    b. Space: Within 1 percent of instrument range.
    c. Water: Within 1 percent of instrument range.

6. Temperature, Dew Point:

    a. Air: Within 1 deg F.
    b. Space: Within 1 deg F.

7. Temperature, Dry Bulb:

    a. Air: Within 2 deg F.
    b. Space: Within 2 deg F.
    c. Heating Hot Water: Within 2 deg F.
    d. Energy Recovery Runaround Liquid: Within 1 deg F.

8. Temperature, Wet Bulb:

    a. Air: Within 1 deg F.
    b. Space: Within 1 deg F.

M. Environmental Conditions for Controllers, Gateways, and Routers:

1. Products to operate without performance degradation under ambient environmental temperature, pressure, and humidity conditions encountered for installed location.

    a. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure to be internally insulated, electrically heated, cooled, and ventilated as required by product and application.

2. Protect products with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. House products not available with integral enclosures complying with requirements indicated in protective secondary enclosures. Installed location dictates the following NEMA 250 enclosure requirements:

    a. Outdoors, Protected: Type 2.
    b. Outdoors, Unprotected: Type 4.
    c. Indoors, Heated with Filtered Ventilation: Type 1.
    d. Indoors, Heated with Non-Filtered Ventilation: Type 2.
    e. Indoors, Heated and Air-Conditioned: Type 1.
    f. Mechanical Equipment Rooms:

        1) Boiler Rooms: Type 12.
        2) Air-Moving Equipment Rooms: Type 1.

    g. Localized Areas Exposed to Washdown: Type 4.
    h. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 2.
    i. Within Duct Systems and Air-Moving Equipment Exposed to Possible Condensation: Type 4

j. Hazardous Locations: Explosion-proof rating for condition.

N. Environmental Conditions for Instruments and Actuators:

1. Instruments and actuators to operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.

a. If instruments and actuators alone cannot comply with requirement, install instruments and actuators in protective enclosures that are isolated and protected from conditions impacting performance. Enclosure is internally insulated, electrically heated, cooled, and ventilated as required by instrument and application.

2. Protect instruments, actuators, and accessories with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. House instruments and actuators not available with integral enclosures complying with requirements indicated in protective secondary enclosures. Installed location is to dictate the following NEMA 250 enclosure requirements:

a. Outdoors, Protected: Type 2.
b. Outdoors, Unprotected: Type 4.
c. Indoors, Heated with Filtered Ventilation: Type 1.
d. Indoors, Heated with Non-Filtered Ventilation: Type 2.
e. Indoors, Heated and Air-conditioned: Type 1.
f. Mechanical Equipment Rooms:

1) Boiler Rooms: Type 12.
2) Air-Moving Equipment Rooms: Type 1.

g. Localized Areas Exposed to Washdown: Type 4.
h. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 2.
i. Within Duct Systems and Air-Moving Equipment Exposed to Possible Condensation: Type 4.
j. Hazardous Locations: Explosion-proof rating for condition.

O. Electric Power Quality:

1. Power-Line Surges:

a. Protect DDC system products connected to ac power circuits from power-line surges to comply with requirements of IEEE C62.41.1 and IEEE C62.41.2.
b. Do not use fuses for surge protection.
c. Test protection in the normal mode and in the common mode, using the following two waveforms:

1) 10-by-1000-microsecond waveform with a peak voltage of 1500 V and a peak current of 60 A.
2) 8-by-20-microssecond waveform with a peak voltage of 1000 V and a peak current of 500 A.

2. Power Conditioning:

a. Protect DDC system products connected to ac power circuits from irregularities and noise rejection. Characteristics of power-line conditioner are as follows:

1) At 85 percent load, output voltage to not deviate by more than plus or minus 1 percent of nominal when input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.
2) During load changes from zero to full load, output voltage to not deviate by more than 2 percent of nominal.
3) Accomplish full correction of load switching disturbances within five cycles, and 95 percent correction within two cycles of onset of disturbance.
4) Total harmonic distortion to not exceed 2 percent at full load.

3. Ground Fault: Protect products from ground fault by providing suitable grounding. Products to not fail due to ground fault condition.

P. Backup Power Source:

1. Serve DDC system products that control HVAC systems and equipment served by a backup power source also from a backup power source.

Q. UPS:

1. DDC system products powered by UPS units are to include the following:

a. Servers.
b. Gateways.
c. DDC controllers.
d. Desktop workstations.

R. Continuity of Operation after Electric Power Interruption:

1. Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems are to automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.

2.4 SYSTEM ARCHITECTURE

A. System architecture consisting of no more than two or three levels of LANs.

1. Level 2 LAN: Connect network controllers and operator workstations.
2. Level 1 or Level 2 LAN: Connect programmable application controllers to other programmable application controllers and to network controllers.
3. Level 2 or Level 3 LAN: Connect application-specific controllers to programmable application controllers and to network controllers.

B. Minimum Data Transfer and Communication Speed:

1. LAN Connecting Operator Workstations and Network Controllers: 100 Mbps.
2. LAN Connecting Programmable Application Controllers: 1000 kbps.
3. LAN Connecting Application-Specific Controllers: 115,000 bps.

C. Provide dedicated and separated DDC system LANs that are not shared with other building systems and tenant data and communication networks.

D. Provide modular system architecture with inherent ability to expand to not less than 1.25 times system size indicated with no impact to performance indicated.

E. Configure architecture to eliminate or minimize need to remove and replace existing network equipment for system expansion.

F. Make number of LANs and associated communication transparent to operator. Configure all I/O points residing on any LAN to be capable of global sharing between all system LANs.

G. Design system to eliminate dependence on any single device for system alarm reporting and control execution. Design each controller to operate independently by performing own control, alarm management, and historical data collection.

2.5 DDC SYSTEM OPERATOR INTERFACES

A. Operator Means of System Access: Operator able to access entire DDC system through any of multiple means including, but not limited to, the following:

1. Desktop and portable workstation with hardwired connection through LAN port.
2. Portable operator terminal with hardwired connection through LAN port.
3. Portable operator workstation with wireless connection through LAN router.
4. Mobile device and application with secured wireless connection through LAN router or cellular data service.
5. Remote connection through web access.

B. Make access to system, regardless of operator means used, transparent to operator.

C. Network Ports: For hardwired connection of desktop or portable workstation. Network port easily accessible, properly protected, clearly labeled, and installed at the following locations:

1. Each mechanical equipment room.
2. Each boiler room.
3. Each outdoor on-grade yard and elevated platform with equipment connected to DDC system.
4. Each different roof level with roof-mounted equipment connected to DDC system.
5. Security system command center.
6. Fire-alarm system command center.

D. Desktop Workstations:

1. Connect desktop workstation(s) to DDC system Level 1 LAN through a communications port directly on LAN or through a communications port on a DDC controller.
2. Able to communicate with any device located on any DDC system LAN.

E. Portable Workstations:

1. Connect portable workstation(s) to DDC system Level 1 LAN through a communications port directly on LAN or through a communications port on a DDC controller.
2. Able to communicate with any device located on any DDC system LAN.

3. Connect to DDC system Level 2 or Level 3 LAN through a communications port on an application-specific controller, or a room temperature sensor connected to an application-specific controller.
4. Connect to system through a wireless router connected to Level 1 LAN.
5. Connect to system through a cellular broadband data service.
6. Portable workstation able to communicate with any device connected to any system LAN regardless of point of physical connection to system.
7. Monitor, program, schedule, adjust set points, and report capabilities of I/O connected anywhere in system.
8. Have dynamic graphic displays that are identical to desktop workstations.

F. POT:

1. Connect DDC controller through a communications port local to controller.
2. Able to communicate with any DDC system controller that is directly connected or with LAN.

G. Mobile Device (Tablet and Smart Phone):

1. Connect Owner-furnished mobile devices to system through a wireless router connected to LAN and cellular data service.
2. Able to communicate with any DDC controller connected to DDC system using dedicated application and secure web access.

H. Critical Alarm Reporting:

1. Send operator-selected critical alarms to notify operator of critical alarms that require immediate attention.
2. Send alarm notification to multiple recipients that are assigned for each alarm.
3. Notify recipients by any or all means, including email, text message, and prerecorded phone message to mobile and landline phone numbers.

I. Simultaneous Operator Use: Capable of accommodating up to five simultaneous operators that are accessing DDC system through any of operator interfaces indicated.

2.6 NETWORKS

A. Acceptable networks for connecting workstations, mobile devices, and network controllers include the following:
1. IP.

B. Acceptable networks for connecting programmable application controllers include the following:
1. IP.

C. Acceptable networks for connecting application-specific controllers include the following:
1. IP.
2. ISO/IEC/IEEE 8802-3, Ethernet.

2.7 NETWORK COMMUNICATION PROTOCOL

A. Use network communication protocol(s) that are open to Owner and available to other companies for use in making future modifications to DDC system.

B. ASHRAE 135 Protocol:

1. Use ASHRAE 135 communication protocol as sole and native protocol used throughout entire DDC system.
2. DDC system to not require use of gateways except to integrate HVAC equipment and other building systems and equipment; not required to use ASHRAE 135 communication protocol.
3. If used, gateways to connect to DDC system using ASHRAE 135 communication protocol and Project object properties and read/write services indicated by interoperability schedule.
4. Use operator workstations, controllers, and other network devices that are tested and listed by BTL.

C. Industry Standard Protocols:

1. Use any one or a combination of the following industry standard protocols for network communication while complying with other DDC system requirements indicated:

    a. ASHRAE 135.

2. Operator workstations and network controllers are to communicate through ASHRAE 135 protocol.
3. Provide portions of DDC system networks using ASHRAE 135 communication protocol as an open implementation of network devices complying with ASHRAE 135. Use network devices that are tested and listed by BTL.
4. Use gateways to connect networks and network devices with different protocols.

2.8 DESKTOP WORKSTATIONS

A. Description: A tower or all-in-one computer designed for normal use at a single, semipermanent location.

B. Performance Requirements:

1. May dictate equipment exceeding minimum requirements indicated.
2. ENERGY STAR compliant.

C. Personal Computer:

1. Minimum Processor Speed: 3 Ghz.
2. RAM:

    a. Capacity: 16 GB.
    b. Speed and Type: 1333 MHz.

3. Hard Drive:

    a. Media: Solid state drive.
    b. Number of Hard Drives: One.
    c. Capacity: 512 GB.

4. Optical Read and Write Drive:

a. Include with at least 2 MB of data buffer.
b. Type: DVD-RW.

c. Average access time of 150 ms or less.
d. MTBF of at least 100,000 power-on hours.

5. At least four expansion slots of 64 bit.
6. Video Card:

a. Resolution: 1920 by 1200 pixels.
b. RAM: 4 GB.
c. Sound:
1) At least 128 voice wavetable synthesis.
2) Capable of delivering three-dimensional sound effects.
3) High-resolution, 16-bit stereo digital audio recording and playback with user-selectable sample rates up to 48,000 Hz.

7. Network Interface:

a. 10-100-1000 base TX Ethernet with RJ-45 connector port.
b. 100 base FX Ethernet with SC or ST port.

D. Wireless Ethernet, 802.11 ac:

1. Optical Modem: Full duplex link for connection to optical fiber cable provided.
2. I/O Ports:

a. Two USB 3.0 ports on front panel, six on back panel, and three internal on motherboard.
b. One serial port.
c. One parallel port.
d. Two PS/2 ports.
e. One RJ-45.
f. One stereo line-in and headphone/line-out on back panel.
g. One microphone and headphone connector on front panel.
h. One IEEE 1394 on front and back panel with PCI-e card.
i. One ESATA port on back panel.

3. Battery: Life of at least three years to maintain system clock/calendar and ROM, at a minimum.

E. Keyboard:

1. 101 enhanced keyboard.
2. Full upper- and lowercase ASCII keyset, numeric keypad, dedicated cursor control keypad, and 12 programmable function keys.
3. Wireless operation within up to 72 inches in front of workstation.

F. Pointing Device:

1. Three-button mouse.
2. Wireless operation within up to 72 inches in front of workstation.

G. Flat Panel Display Monitor:

1. Display:

    a. Color display with 24” diagonal viewable area.
    b. Digital input signal.
    c. Aspect Ratio: 16 to 9.
    d. Antiglare display.
    e. Dynamic Contrast Ratio: 50000 to 1.
    f. Brightness: 250 cd/sq. m.
    g. Tilt adjustable base.
    h. ENERGY STAR compliant.
    i. Resolution: 1920 by 1080 pixels at 60 Hz with pixel size of 0.277 mm or smaller.
    j. Number of Displays: One.

H. Speakers:

1. Two, with individual controls for volume, bass and treble.
2. Signal to Noise Ratio: At least 65 dB.
3. Power: At least 4 W per speaker/channel.
4. Magnetic shielding to prevent distortion on the video monitor.

I. I/O Cabling: Include applicable cabling to connect I/O devices.

2.9 SYSTEM SOFTWARE

A. System Software Minimum Requirements:

1. Real-time multitasking and multiuser 64-bit operating system that allows concurrent multiple operator workstations operating and concurrent execution of multiple real-time programs and custom program development.
2. Operating system capable of operating DOS and Microsoft Windows applications.
3. Database management software to manage all data on an integrated and non-redundant basis. Additions and deletions to database are to be without detriment to existing data. Include cross linkages so no data required by a program can be deleted by an operator until that data have been deleted from respective programs.
4. Network communications software to manage and control multiple network communications to provide exchange of global information and execution of global programs.
5. Operator interface software to include day-to-day operator transaction processing, alarm and report handling, operator privilege level and data segregation control, custom programming, and online data modification capability.
6. Scheduling software to schedule centrally based time and event, temporary, and exception day programs.

B. Operator Interface Software:

1. Minimize operator training through use of English language prorating and English language point identification.
2. Minimize use of a typewriter-style keyboard through use of a pointing device similar to a mouse.
3. Make operator sign-off a manual operation or, if no keyboard or mouse activity takes place, an automatic sign-off.
4. Make automatic sign-off period programmable from one to 60 minutes in one-minute increments on a per operator basis.

5. Record operator sign-on and sign-off activity and send to printer.
6. Security Access:

    a. Use password control for operator access to DDC system.
    b. Assign an alphanumeric password (field assignable) to each operator.
    c. Grant operators access to DDC system by entry of proper password.
    d. Use same operator password regardless of which computer or other operator interface means are used.
    e. Automatically update additions or changes made to passwords.
    f. Assign each operator an access level to restrict access to data and functions the operator is cable of performing.
    g. Provide software with at least five access levels.
    h. Assign each menu item an access level so that a one-for-one correspondence between operator assigned access level(s) and menu item access level(s) is required to gain access to menu item.
    i. Display menu items to operator with those capable of access highlighted. Make menu and operator access level assignments online programmable and under password control.

7. Data Segregation:

    a. Include data segregation for control of specific data routed to a workstation, to an operator or to a specific output device, such as a printer.
    b. Include at least 32 segregation groups.
    c. Make segregation groups selectable such as "fire points," "fire points on second floor," "space temperature points," "HVAC points," and so on.
    d. Make points assignable to multiple segregation groups. Display and output of data to printer or monitor is to occur where there is a match of operator or peripheral segregation group assignment and point segregations.
    e. Make alarms displayed and printed at each peripheral to which segregation allows, but only those operators assigned to peripheral and having proper authorization level will be allowed to acknowledge alarms.
    f. Assign operators and peripherals to multiple segregation groups and make all assignments online programmable and under password control.

8. Operators able to perform commands including, but not limited to, the following:

    a. Start or stop selected equipment.
    b. Adjust set points.
    c. Add, modify, and delete time programming.
    d. Enable and disable process execution.
    e. Lock and unlock alarm reporting for each point.
    f. Enable and disable totalization for each point.
    g. Enable and disable trending for each point.
    h. Override control loop set points.
    i. Enter temporary override schedules.
    j. Define holiday schedules.
    k. Change time and date.
    l. Enter and modify analog alarm limits.
    m. Enter and modify analog warning limits.
    n. View limits.
    o. Enable and disable demand limiting.
    p. Enable and disable duty cycle.
    q. Display logic programming for each control sequence.

9. Reporting:

    a. Generated automatically and manually.
    b. Sent to displays, printers and disc files.
    c. Types of Reporting:

        1) General listing of points.
        2) List points currently in alarm.
        3) List of off-line points.
        4) List points currently in override status.
        5) List of disabled points.
        6) List points currently locked out.
        7) List of items defined in a "Follow-Up" file.
        8) List weekly schedules.
        9) List holiday programming.
        10) List of limits and deadbands.

10. Summaries: For specific points, for a logical point group, for an operator selected group(s), or for entire system without restriction due to hardware configuration.

C. Graphic Interface Software:

1. Include a full interactive graphical selection means of accessing and displaying system data to operator. Include at least five levels with the penetration path operator assignable (for example, site, building, floor, air-handling unit, and supply temperature loop). Native language descriptors assigned to menu items are to be operator defined and modifiable under password control.
2. Include a hierarchical-linked dynamic graphic operator interface for accessing and displaying system data and commanding and modifying equipment operation. Interface is to use a pointing device with pull-down or penetrating menus, color, and animation to facilitate operator understanding of system.
3. Include at least 10 levels of graphic penetration with the hierarchy operator assignable.
4. Make descriptors for graphics, points, alarms, and such modifiable through operator's workstation under password control.
5. Make graphic displays online user definable and modifiable using the hardware and software provided.
6. Make data displayed within a graphic assignable regardless of physical hardware address, communication, or point type.
7. Make graphics online programmable and under password control.
8. Make points assignable to multiple graphics where necessary to facilitate operator understanding of system operation.
9. Graphics to also contain software points.
10. Penetration within a graphic hierarchy is to display each graphic name as graphics are selected to facilitate operator understanding.
11. Provide a back-trace feature to permit operator to move upward in the hierarchy using a pointing device. Back trace to show all previous penetration levels. Include operator with option of showing each graphic full-screen size with back trace as horizontal header or by showing a "stack" of graphics, each with a back trace.
12. Display operator accessed data on the monitor.
13. Provide operator with ability to select further penetration using pointing device to click on a site, building, floor, area, equipment, and so on. Display defined and linked graphic below that selection.
14. Include operator with means to directly access graphics without going through penetration path.

15. Make dynamic data assignable to graphics.
16. Display points (physical and software) with dynamic data provided by DDC system with appropriate text descriptors, status or value, and engineering unit.
17. Use color, rotation, or other highly visible means, to denote status and alarm states. Make colors variable for each class of points, as chosen by operator.
18. Provide dynamic points with operator adjustable update rates on a per point basis from one second to over a minute.
19. For operators with appropriate privilege, command points directly from display using pointing device.

    a. For an analog command point such as set point, display current conditions and limits so operator can position new set point using pointing device.
    b. For a digital command point such as valve position, show valve in current state such as open or closed so operator could select alternative position using pointing device.
    c. Include a keyboard equivalent for those operators with that preference.

20. Give operator ability to split or resize viewing screen into quadrants to show one graphic on one quadrant of screen and other graphics or spreadsheet, bar chart, word processing, curve plot, and other information on other quadrants on screen. This feature allows real-time monitoring of one part of system while displaying other parts of system or data to better facilitate overall system operation.
21. Help Features:

    a. Online context-sensitive help utility to facilitate operator training and understanding.
    b. Bridge to further explanation of selected keywords and contain text and graphics to clarify system operation.

        1) If help feature does not have ability to bridge on keywords for more information, provide a complete set of user manuals in an indexed word-processing program, which runs concurrently with operating system software.

    c. Available for Every Menu Item:

        1) Index items for each system menu item.

22. Provide graphic generation software to allow operator ability to add, modify, or delete system graphic displays.

    a. Include libraries of symbols depicting HVAC symbols such as fans, coils, filters, dampers, valves pumps, and electrical symbols similar to those indicated.
    b. Use a pointing device in conjunction with a drawing program to allow operator to perform the following:

        1) Define background screens.
        2) Define connecting lines and curves.
        3) Locate, orient, and size descriptive text.
        4) Define and display colors for all elements.
        5) Establish correlation between symbols or text and associated system points or other displays.

D. Project-Specific Graphics: Graphics documentation including, but not limited to, the following:

1. Site plan showing each building, and additional site elements, which are being controlled or monitored by DDC system.
2. Plan for each building floor, including interstitial floors, and each roof level of each building, showing the following:

    a. Room layouts with room identification and name.
    b. Locations and identification of all monitored and controlled HVAC equipment and other equipment being monitored and controlled by DDC system.
    c. Location and identification of each hardware point being controlled or monitored by DDC system.

3. Control schematic for each of following, including a graphic system schematic representation, similar to that indicated on Drawings, with point identification, set point and dynamic value indication, sequence of operation and control logic diagram.
4. Graphic display for each piece of equipment connected to DDC system through a data communications link. Include dynamic indication of all points associated with equipment.
5. DDC system network riser diagram that shows schematic layout for entire system including all networks and all controllers, gateways operator workstations and other network devices.
6. SDP specific requirements:
    a. Site plan with links to floor plans
    b. Floor plans with sensor locations on the floor plan and links to equipment
    c. Boiler room
    d. Classrooms
    e. Administrative offices
    f. Gym/cafeteria/auditorium
    g. HVAC equipment with links to equipment graphics, including alarm, setpoint, and schedule adjustments

E. Customizing Software:

1. Software to modify and tailor DDC system to specific and unique requirements of equipment installed, to programs implemented and to staffing and operational practices planned.
2. Online modification of DDC system configuration, program parameters, and database using menu selection and keyboard entry of data into preformatted display templates.
3. At a minimum, include the following modification capability:

    a. Operator Assignment: Designation of operator passwords, access levels, point segregation, and auto sign-off.
    b. Peripheral Assignment: Assignment of segregation groups and operators to consoles and printers, designation of backup workstations and printers, designation of workstation header points, and enabling and disabling of print-out of operator changes.
    c. System Configuration and Diagnostics; Communications and peripheral port assignments, DDC controller assignments to network, DDC controller enable and disable, assignment of command trace to points, and application programs and initiation of diagnostics.
    d. System Text Addition and Change: English or native language descriptors for points, segregation groups and access levels and action messages for alarms, run time, and trouble condition.
    e. Time and Schedule Change: Time and date set, time and occupancy schedules, exception and holiday schedules, and daylight-savings time schedules.
    f. Point related change capability is to include the following:

1) System and point enable and disable.
2) Run-time enable and disable.
3) Assignment of points to segregation groups, calibration tables, lockout, and run time and to a fixed I/O value.
4) Assignment of alarm and warning limits.

g. Application program change capability is to include the following:

1) Enable and disable of software programs.
2) Programming changes.
3) Assignment of comfort limits, global points, time and event initiators, time and event schedules and enable and disable time and event programs.

4. Provide software to allow operator ability to add points, or groups of points, to DDC system and to link them to energy optimization and management programs. Make additions and modifications online programmable using operator workstations, downloaded to other network devices and entered into their databases. After verification of point additions and associated program operation, upload and record database on hard drive and disc for archived record.
5. Include high-level language programming software capability for implementation of custom DDC programs. Include a compiler, linker, and up- and down-load capability.
6. Include a library of DDC algorithms, intrinsic control operators, arithmetic, logic, and relational operators for implementation of control sequences. Also include, at a minimum, the following:

a. Proportional control (P).
b. Proportional plus integral (PI).
c. Proportional plus integral plus derivative (PID).
d. Adaptive and intelligent self-learning control.

1) Algorithm monitors loop response to output corrections and adjust loop response characteristics in accordance with time constant changes imposed.
2) Algorithm operates in a continuous self-learning manner and retains in memory a stored record of system dynamics so that on system shut down and restart, learning process starts from where it left off.

7. Fully implemented intrinsic control operators including sequence, reversing, ratio, time delay, time of day, highest select AO, lowest select AO, analog controlled digital output, analog control AO, and digitally controlled AO.
8. Logic operators such as "And," "Or," "Not," and others that are part of a standard set available with a high-level language.
9. Arithmetic operators such as "Add," "Subtract," "Multiply," "Divide," and others that are part of a standard set available with a high-level language.
10. Relational operators such as "Equal to," "Not Equal to," "Less Than," "Greater Than," and others that are part of a standard set available with a high-level language.

F. Alarm Handling Software:

1. Include alarm handling software to report all alarm conditions monitored and transmitted through DDC controllers, gateways and other network devices.
2. Include first in, first out handling of alarms in accordance with alarm priority ranking, with most critical alarms first, and with buffer storage in case of simultaneous and multiple alarms.

3. Make alarm handling active at all times to ensure that alarms are processed even if an operator is not currently signed on to DDC system.
4. Alarms display is to include the following:

    a. Indication of alarm condition such as "Abnormal Off," "Hi Alarm," and "Low Alarm."
    b. "Analog Value" or "Status" group and point identification with native language point descriptor such as "Space Temperature, Building 110, 2nd Floor, Room 212."
    c. Discrete per point alarm action message, such as "Call Maintenance Dept. Ext-5561."
    d. Include extended message capability to allow assignment and printing of extended action messages. Capability is to be operator programmable and assignable on a per point basis.

5. Direct alarms to appropriate operator workstations, printers, and individual operators by privilege level and segregation assignments.
6. Send email alarm messages to designated operators.
7. Send email, page, text, and voice messages to designated operators for critical alarms.
8. Categorize and process alarms by class.

    a. Class 1:

        1) Associated with fire, security, and other extremely critical equipment monitoring functions; have alarm, trouble, return to normal, and acknowledge conditions printed and displayed.
        2) Unacknowledged alarms to be placed in unacknowledged alarm buffer.
        3) All conditions make an audible alarm sound and require individual acknowledgment to silence audible sound.

    b. Class 2:

        1) Critical, but not life-safety related, and processed same as Class 1 alarms, except do not require individual acknowledgment.
        2) Acknowledgement may be through a multiple alarm acknowledgment.

    c. Class 3:

        1) General alarms; printed, displayed, and placed in unacknowledged alarm buffer queues.
        2) Configure so each new alarm received makes an audible alarm sound that are silenced by "acknowledging" alarm or by pressing a "silence" key.
        3) Make acknowledgement of queued alarms either on an individual basis or through a multiple alarm acknowledgement.
        4) Print alarms returning to normal condition without an audible alarm sound or require acknowledgment.

    d. Class 4:

        1) Routine maintenance or other types of warning alarms.
        2) Alarms to be printed only, with no display, no audible sound and no acknowledgment required.

9. Include an unacknowledged alarm indicator on display to alert operator that there are unacknowledged alarms in system. Operator able to acknowledge alarms on an individual basis or through a multiple alarm acknowledge key, depending on alarm class.

10. To ensure that no alarm records are lost, make it possible to assign a backup printer to accept alarms in case of failure of primary printer.

G. Reports and Logs:

1. Include reporting software package that allows operator to select, modify, or create reports using DDC system I/O point data available.
2. Setup each report so data content, format, interval, and date are operator definable.
3. Sample and store report data on DDC controller, within storage limits of DDC controller, and then uploaded to archive on server for historical reporting.
4. Make it possible for operators to obtain real-time logs of all I/O points by type or status, such as alarm, point lockout, or normal.
5. Store reports and logs on workstations and servers hard drives in a format that is readily accessible by other standard software applications, including spreadsheets and word processing.
6. Make reports and logs readily printable and set to be print either on operator command or at a specific time each day.

H. Standard Reports: Provide standard DDC system reports with operator ability to customize reports later.

1. All I/O: With current status and values.
2. Alarm: All current alarms, except those in alarm lockout.
3. Disabled I/O: All I/O points that are disabled.
4. Alarm Lockout I/O: All I/O points in alarm lockout, whether manual or automatic.
5. Alarm Lockout I/O in Alarm: All I/O in alarm lockout that are currently in alarm.
6. Logs:

    a. Alarm history.
    b. System messages.
    c. System events.
    d. Trends.

I. Custom Reports: Operator able to easily define and prepare any system data into a daily, weekly, monthly, annual, or other historical report. Reports to include a title with time and date stamp.

J. Standard Trends:

1. Trend all I/O point present values, set points, and other parameters indicated for trending.
2. Associate trends into groups, and setup a trend report for each group.
3. Store trends within DDC controller and uploaded to hard drives automatically on reaching 75 percent of DDC controller buffer limit, or by operator request, or by archiving time schedule.
4. Preset trend intervals for each I/O point after review with Owner.
5. Make trend intervals operator selectable from 10 seconds up to 60 minutes. Make minimum number of consecutive trend values stored at one time 100 per variable.
6. When drive storage memory is full, overwrite oldest data with most recent data.
7. Make archived and real-time trend data available for viewing numerically and graphically by operators.

K. Custom Trends: Operator-definable custom trend log for any I/O point in DDC system.

1. Include each trend with interval, start time, and stop time.

2. Sample and store data on DDC controller, within reaching 75 percent storage limits of DDC controller, and then uploaded to archive on server hard drives.
3. Make data retrievable for use in spreadsheets and standard database programs.

L. Programming Software:

1. Include programming software to execute sequences of operation indicated.
2. Include programming routines in simple and easy to follow logic with detailed text comments describing what the logic does and how it corresponds to sequence of operation.
3. Programming software is to be as follows one of the following:

    a. Graphic Based: Use a library of function blocks made from preprogrammed code designed for DDC control systems.

        1) Assemble function blocks with interconnection lines that represent to control sequence in a flowchart.
        2) Make programming tools viewable in real time to show present values and logical results of each function block.

4. Include means for detecting programming errors and testing software control strategies with a simulation tool before implementing in actual control. Simulation tool may be inherent with programming software or as a separate product.

M. Database Management Software:

1. Where a separate SQL database is used for information storage, include database management software that separates database monitoring and managing functions by supporting multiple separate windows.
2. Secure database access using standard SQL authentication including ability to access data for use outside of DDC system applications.
3. Include database management function summarizing information on trend, alarm, event, and audit for the following database management actions:

    a. Backup.
    b. Purge.
    c. Restore.

4. Database management software supporting the following:

    a. Statistics: Display database server information and trend, alarm, event, and audit information on database.
    b. Maintenance: Include method of purging records from trend, alarm, event, and audit databases by supporting separate screens for creating a backup before purging, selecting database, and allowing for retention of a selected number of day's data.
    c. Backup: Include means to create a database backup file and select a storage location.
    d. Restore: Include a restricted means of restoring a database by requiring operator to have proper security level.

5. Information of current database activity, including the following:

    a. Ready.

b. Purging record from a database.
c. Action failed.
d. Refreshing statistics.
e. Restoring database.
f. Shrinking a database.
g. Backing up a database.
h. Resetting Internet information services.
i. Starting network device manager.
j. Shutting down the network device manager.
k. Action successful.

6. Database management software monitoring functions is to continuously read database information once operator has logged on.
7. Include operator notification through on-screen pop-up display and email message when database value has exceeded a warning or alarm limit.
8. Monitoring settings window with the following Sections:

a. Allow operator to set and review scan intervals and start times.
b. Email: Allow operator to create and review email and phone text messages to be delivered when a warning or an alarm is generated.
c. Warning: Allow operator to define warning limit parameters, set reminder frequency, and link email message.
d. Alarm: Allow operator to define alarm limit parameters, set reminder frequency, and link email message.
e. Database Login: Protect system from unauthorized database manipulation by creating a read access and a write access for each of trend, alarm, event, and audit databases as well as operator proper security access to restore a database.

9. Monitoring settings taskbar with following informational icons:

a. Normal: Indicates by color and size, or other easily identifiable means, that all databases are within their limits.
b. Warning: Indicates by color and size, or other easily identifiable means, that one or more databases have exceeded their warning limit.
c. Alarm: Indicates by color and size, or other easily identifiable means, that one or more databases have exceeded their alarm limit.

2.10 ANALYTICS SOFTWARE

A. Scope: Incorporate analytics software into DDC System:

1. Licensing, without Recurring Cost: No re-occurring cost for licensing and subscriptions.
2. Licensing: With or without re-occurring cost for licensing and subscriptions.

a. For products with re-occurring costs, provide incremental costs broken down over a five-year operating period that begins at Substantial Completion.
b. Setup service agreements direct to Owner.

3. Purpose: Analyze energy and operational data to identify faults and opportunities for improved performance and reduced energy use.
4. Verification: Verify that HVAC systems and associated sequence of operations are executing as specified or as described on Drawings, through the analysis of energy and operational data, identification of faults showing where control sequences are not

functioning as prescribed, and identification of opportunities for improved performance in the operation of systems.

B. Use during Project Life:

1. During Construction: Use for verification of performance during startup, commissioning, and final acceptance of DDC system.
2. During Warranty Period: Use for continuous operational tuning of DDC system and verification of operation and designed to identify warranty issues preemptively, thus reducing failures and potential down time.
3. After Warranty Period: Use to diagnose ongoing operational degradation and for Owner to perform continuous monitoring-based commissioning.

C. Minimum Features and Capabilities:

1. Operating Systems: Current version of Windows-based operating systems.
2. Time Series Database: Database technology, designed for efficient storage and analysis of large volumes of time series data, using tagging to model and describe data; supports an open-source tagging standard.
3. Data Import: Ability to accept and normalize data from a variety of sources including SQL compatible databases, CSV format files, XML format files or web services, and other EDI techniques. Once imported, software is to provide a unified data format to enable analytics algorithms to identify patterns across different data sets.
4. Open Interfaces: Open, REST-based APIs to enable integration with third-party software applications. Open APIs are to enable data to be entered/imported into database, exported from database, posting of analytic queries, and output of analytic results. APIs are to be fully documented and available as part of standard product.
5. Host: Local deployed on DDC system network.
6. Weather Data Service: Built-in worldwide weather service providing weather data including, but not limited to, the following:

    a. Current temperature.
    b. High temperature for the day.
    c. Low temperature for the day.
    d. Sunrise and sunset times.
    e. Relative humidity.
    f. Degree days (heating and cooling with adjustable balance point value).
    g. Seven-day forecast.
    h. Historical weather data extending back at least one year.

7. Email Notification: Automatic notification of detected issues via email including, but not limited to, the following:

    a. Immediate notification of detected issues.
    b. Daily digest or summary of detected issues.
    c. Ability to delineate which notifications are sent to which recipients down to the level of specifying individual issues sent to individual recipients.

D. Hardware Requirements:

1. Host on a server in a virtual environment complying with Owner's security requirements.
2. Comply with standard software and hardware profiles required by Owner.

E. Analytic Rules:

1. Custom Rule Development: Develop customized rules and algorithms tailored to operational needs and characteristics of individual facilities and needs of monitoring and verification project and fault-detection requirements of Project without depending on manufacturer for rule development. Provide tools for user development and full documentation.
2. Standard Analytic Functions: Library of standard analytic functions is to use these standard analytic functions as elements to build custom analytic rules for specific needs of individual facilities.
3. Existing library of not less than 200 standard analytic rules written for applications similar to those required for this Project.

F. Reporting:

1. Standard Views of Analytic Results: Standard views to present analytic results, automatically generated when issues are found by analytic rules including, but not limited to, the following:

    a. Rules violations across a portfolio of sites, rules violations per site, including time, date, and duration of all violations.
    b. Ability to assign cost relationships to rule logic to provide cost per violation.
    c. Standard filters to enable operator to easily look at rule violations by site, data, and violation type for any selected date or date range.
    d. Automatic calculation and presentation of Key Performance Indicators (KPIs) and to define custom KPIs as needed.

2. Custom Views of Analytic Results:

    a. Any standard system view is to be able to be saved as a custom report including its configuration criteria, e.g., time range, sites, rule violations, or other configuration options as applicable to standard system view.
    b. Created by making queries against the database and saving the query as a saved report executed by single mouse click.
    c. Export: Support report views export into CSV, Excel, XML, and HTML format, accomplished in a couple of mouse clicks.

G. Energy-Specific Reporting and Information Presentation Tools:

1. Greenhouse Gas Analysis: Energy/carbon dioxide relationships; easily changed and added without involvement of software manufacturer.
2. Energy Baseline: Quantify and define energy consumption and demand baselines (including weather normalization metrics) and compare actual and forecasted energy demand and consumption against those baselines.
3. Benchmarking: Multisite benchmarking to compare energy consumption and demand profiles and baselines across all buildings within Owner's portfolio.
4. Forecasting: Forecast near-future loads by using historic trends and forecasted weather data.
5. Financial Analysis: Calculate costs based on energy consumption and demand and energy costs and associate costs with any faults discovered by any analytic function and perform model- or tariff-based calculations to determine costs.
6. Tracking of Key Performance Indicators: Definition and tracking of user-defined key performance indicators/operational metrics. Examples include energy demand and consumption normalized for area and weather, peak demand, and consumption shown with minimum and maximum ranges across any user-selectable period.

7. Correlation of Energy Use with Equipment Operation: Automatically present views showing correlation between energy demand and consumption and operation of loads associated with that usage. Include the following:

   a. All submeters and virtual meters.
   b. Weather data as a selectable item.

H. Implementation:

1. Apply analytic rules to all HVAC systems and equipment monitored and controlled by DDC system. To extent available, use a subset of rules in existing rules library.
2. Implement rules to aid in determining proper operation of any HVAC system with a programmed sequence of operation.
3. Generate reports to aid in verification of proper operation during initial system startup and commissioning to supplement (not replace) commissioning agent reports.
4. Prepare quarterly reports summarizing faults detected and KPIs, including recommended corrective action.

I. Training:

1. Train Owner sufficiently to use software without need for external support.

2.11 OFFICE APPLICATION SOFTWARE

A. Include current version of office application software at time of Substantial Completion.

B. Office application software package to include multiple separate applications and use a common platform for all applications.

1. Database.
2. Email.
3. Presentation.
4. Publishing.
5. Spreadsheet.
6. Word processing.

2.12 ASHRAE 135 GATEWAYS

A. Include BACnet communication ports, whenever available as an equipment OEM standard option, for integration via a single communication cable. BACnet-controlled plant equipment includes, but is not limited to, boilers and variable-speed drives.

B. Include gateways to connect BACnet to legacy systems where indicated, existing non-BACnet devices, and existing non-BACnet DDC-controlled equipment.

C. Include with each gateway an interoperability schedule showing each point or event on legacy side that BACnet "client" will read, and each parameter that BACnet network will write to. Describe this interoperability of BACnet services, or BIBBs, defined in ASHRAE 135, Annex K.

D. Gateway Minimum Requirements:

1. Read and view all readable object properties on non-BACnet network to BACnet network, and vice versa, where applicable.
2. Write to all writable object properties on non-BACnet network from BACnet network, and vice versa, where applicable.
3. Include single-pass (only one protocol to BACnet without intermediary protocols) translation from non-BACnet protocol to BACnet, and vice versa.
4. Comply with requirements of Data Sharing Read Property, Data Sharing Write Property, Device Management Dynamic Device Binding-B, and Device Management Communication Control BIBBs in accordance with ASHRAE 135.
5. Hardware, software, software licenses, and configuration tools for operator-to-gateway communications.
6. Backup programming and parameters on CD media with ability to modify, download, backup, and restore gateway configuration.

2.13 DDC CONTROLLERS

A. DDC system consisting of a combination of network controllers, programmable application controllers, and application-specific controllers to satisfy performance requirements indicated.

B. DDC controllers to perform monitoring, control, energy optimization, and other requirements indicated.

C. DDC controllers are to use a multitasking, multiuser, real-time digital control microprocessor with a distributed network database and intelligence.

D. Each DDC controller is capable of full and complete operation as a completely independent unit and as a part of DDC system wide distributed network.

E. Environment Requirements:

1. Controller hardware suitable for anticipated ambient conditions.
2. Controllers located in conditioned space rated for operation at 32 to 120 deg F.
3. Controllers located outdoors rated for operation at 40 to 150 deg F.

F. Power and Noise Immunity:

1. Operate controller at 90 to 110 percent of nominal voltage rating and perform an orderly shutdown below 80 percent of nominal voltage.
2. Protect against electrical noise of 5 to 120 Hz and from keyed radios with up to 5 W of power located within 36 inches of enclosure.

G. DDC Controller Spare Processing Capacity:

1. Include spare processing memory for each controller. RAM, PROM, or EEPROM will implement requirements indicated with the following spare memory:

   a. Network Controllers: 50 percent.
   b. Programmable Application Controllers: Not less than 60 percent.
   c. Application-Specific Controllers: Not less than 70 percent.

2. Memory for DDC controller's operating system and database are to include the following:

   a. Monitoring and control.

b. Energy management, operation, and optimization applications.
c. Alarm management.
d. Historical trend data of all connected I/O points.
e. Maintenance applications.
f. Operator interfaces.
g. Monitoring of manual overrides.

H. DDC Controller Spare I/O Point Capacity: Include spare I/O point capacity for each controller as follows:

1. Network Controllers:

a. 10 percent of each AI, AO, BI, and BO point connected to controller.
b. Minimum Spare I/O Points per Controller:

1) AIs: Two.
2) AOs: Two.
3) BIs: Three.
4) BOs: Three.
5) Option to provide universal I/O to meet spare requirements.

2. Programmable Application Controllers:

a. 10 percent of each AI, AO, BI, and BO point connected to controller.
b. Minimum Spare I/O Points per Controller:

1) AIs: Two.
2) AOs: Two.
3) BIs: Three.
4) BOs: Three.
5) Option to provide universal I/O to meet spare requirements.

3. Application-Specific Controllers:

a. 10 percent of each AI, AO, BI, and BO point connected to controller.
b. Minimum Spare I/O Points per Controller:

1) AIs: One.
2) AOs: One.
3) BIs: One.
4) BOs: One.
5) Option to provide universal I/O to meet spare requirements.

I. Maintenance and Support: Include the following features to facilitate maintenance and support:

1. Mount microprocessor components on circuit cards for ease of removal and replacement.
2. Means to quickly and easily disconnect controller from network.
3. Means to quickly and easily access connect to field test equipment.
4. Visual indication that controller electric power is on, of communication fault or trouble, and that controller is receiving and sending signals to network.

J. I/O Point Interface:

1. Connect hardwired I/O points to network, programmable application, and application-specific controllers.
2. Protect I/O points so shorting of point to itself, to another point, or to ground will not damage controller.
3. Protect I/O points from voltage up to 24 V of any duration so that contact will not damage controller.
4. AIs:

    a. Include monitoring of low-voltage (0 to 10 V dc), current (4 to 20 mA) and resistance signals from thermistor and RTD sensors.
    b. Compatible with, and field configurable to, sensor and transmitters installed.
    c. Perform analog-to-digital (A-to-D) conversion with a minimum resolution of 8 bits or better to comply with accuracy requirements indicated.
    d. Signal conditioning including transient rejection for each AI.
    e. Capable of being individually calibrated for zero and span.
    f. Incorporate common-mode noise rejection of at least 50 dB from 0 to 100 Hz for differential inputs, and normal-mode noise rejection of at least 20 dB at 60 Hz from a source impedance of 10000 ohms.
    g. External conversion resistors are not permitted.

5. AOs:

    a. Perform analog-to-digital (A-to-D) conversion with a minimum resolution of 8 bits or better to comply with accuracy requirements indicated.
    b. Output signals range of 4 to 20 mA dc or0 to 10 V dc as required to include proper control of output device.
    c. Capable of being individually calibrated for zero and span.
    d. Drift is to be not greater than 0.4 percent of range per year.
    e. External conversion resistors are not permitted.

6. BIs:

    a. Accept contact closures and ignore transients of less than 5 ms duration.
    b. Isolate and protect against an applied steady-state voltage of up to 180 V ac peak.
    c. Include a wetting current of at least 12 mA to be compatible with commonly available control devices and protected against effects of contact bounce and noise.
    d. Sense "dry contact" closure without external power (other than that provided by controller) being applied.
    e. Pulse accumulation input points complying with all requirements of BIs and accept up to 10 pulses per second for pulse accumulation. Include buffer to totalize pulses. Pulse accumulator is to accept rates of at least 20 pulses per second. Reset the totalized value to zero on operator's command.

7. BOs:

    a. Include relay contact closures or triac outputs for momentary and maintained operation of output devices.

        1) Relay contact closures to have a minimum duration of 0.1 second and at least 180 V of isolation.
        2) Include electromagnetic interference suppression on all output lines to limit transients to non-damaging levels.
        3) Minimum contact rating to be 1 A at 24 V ac.

4) Triac outputs to have at least 180 V of isolation and minimum contact rating of 1 A at 24 V ac.

b. Include BOs with two-state operation or a pulsed low-voltage signal for pulse-width modulation control.
c. BOs to be selectable for either normally open or normally closed operation.
d. Include tristate outputs (two coordinated BOs) for control of three-point, floating- type electronic actuators without feedback.
e. Limit use of three-point floating devices to VAV terminal unit control applications, and other applications indicated on Drawings,. Control algorithms to operate actuator to one end of its stroke once every 12 hours for verification of operator tracking.

2.14 NETWORK CONTROLLERS

A. General:

1. Include adequate number of controllers to achieve performance indicated.
2. Provide one or more independent, standalone, microprocessor-based network controllers to manage global strategies indicated.
3. Include enough memory to support its operating system, database, and programming requirements with spare memory indicated.
4. Share data between networked controllers and other network devices.
5. Operating system of controller to manage I/O communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
6. Include network controllers with a real-time clock.
7. Controller to continually check status of its processor and memory circuits. If an abnormal operation is detected, controller is to assume a predetermined failure mode and generate an alarm notification.
8. Make controllers fully programmable.

B. Communication:

1. Network controllers communicate with other devices on DDC system Level 1 network.
2. Network controller to also perform routing if connected to network of programmable application controllers and application-specific controllers.

C. Operator Interface:

1. Equip controllers with a service communications port for connection to portable operator's workstation or mobile device.
2. Local Keypad and Display:

a. Equip controller with local keypad and digital display for interrogating and editing data.
b. Use of keypad and display requires a security password.

D. Serviceability:

1. Equip controller with diagnostic LEDs or other form of local visual indication of power, communication, and processor.

2. Connect wiring and cable connections to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Maintain Basic Input Output System (BIOS) and programming information in event of power loss for at least 72 hours.

2.15 PROGRAMMABLE APPLICATION CONTROLLERS

A. General:

1. Include adequate number of controllers to achieve performance indicated.
2. Provide enough memory to support its operating system, database, and programming requirements with spare memory indicated.
3. Share data between networked controllers and other network devices.
4. Include controller with operating system to manage I/O communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
5. Include controllers that perform scheduling with a real-time clock.
6. Controller is to continually check status of its processor and memory circuits. If an abnormal operation is detected, controller assumes a predetermined failure mode and generates an alarm notification.
7. Fully programmable.

B. Communication:

1. Programmable application controllers are to communicate with other devices on network.

C. Operator Interface:

1. Equip controllers with a service communications port for connection to portable operator's workstation or mobile device.
2. Local Keypad and Display:

    a. Equip controller with local keypad and digital display for interrogating and editing data.
    b. Protect use of keypad and display by security password.

D. Serviceability:

1. Equip controller with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Connect wiring and cable connections to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Maintain BIOS and programming information in event of power loss for at least 72 hours.

2.16 APPLICATION-SPECIFIC CONTROLLERS

A. Description: Microprocessor-based controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment or system. Controllers are not fully user-programmable but are configurable and customizable for operation of equipment they are designed to control.

1. Capable of standalone operation and continued control functions without being connected to network.
2. Share data between networked controllers and other network devices.

B. Communication: Application-specific controllers are to communicate with other application-specific controllers and devices on network, and to programmable application controllers and network controllers.

C. Operator Interface: Equip controllers with a service communications port for connection to portable operator's workstation or mobile device. Connection is to extend to port on space temperature sensor that is connected to controller.

D. Serviceability:

1. Equip controller with diagnostic LEDs or other form of local visual indication of power, communication, and processor.
2. Connect wiring and cable connections to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Use nonvolatile memory and maintain all BIOS and programming information in event of power loss.

2.17 AAC ROOM SENSORS

A. The AAC Sensor shall provide room temperature value and humidity to the controller.

B. Each AAC shall support a minimum of two sensors.

C. The AAC Sensor shall connect directly to the controller and shall not utilize any of the I/O points of the controller.

D. The AAC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive.

E. The AAC Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering.

F. The AAC Sensor shall allow for the customization of the color on the esthetic covering as a standard offering.

G. The AAC Sensor shall be supplied in the following manner:

1. LCD display for showing (typically) the current temperature..
2. Tenant override to allow timed override of unoccupied to occupied mode of operation.
3. LED indication of override state.
4. Up/Down keys to allow adjustment of the current setpoint.
5. User interface with the AAC Sensor shall be provided as a configurable function, and shall offer password protection for access to network variable editing.
6. ASHRAE 95 compliance (LCD display and sub-base functionality)
7. The room sensor shall provide access to additional diagnostic data from a sensor-user keypad request. This Diagnostic mode is displayed on the LCD screens and includes separate displays for the controllers: Submet and Node Address, Errors, Alarms, Temperature Offset.

2.18 UNITARY EQUIPMENT CONTROLLER UNITS

A. Single board construction comprising processor board with programmable, nonvolatile, RAM/EEPROM memory for custom control and unitary applications. ASCs shall be provided for Unit Ventilators, Fan Coils, Heat Pumps, Rooftop Units, and other applications as shown on the drawings. To assure complete interoperability, all UEC's firmware shall support all BACnet objects and services as called out in the PIC and BIBBs.

B. The Unitary Equipment Controller shall have the following point count as a minimum indicated on contract drawings.

1. Universal Inputs:
   a. 0-20mA.
   b. 0-5 VDC
   c. Balco Sensors
   d. Platinum Sensor
   e. 10K thermistor.

2. Analog Outputs:
   a. 0-20mA.
   b. 0-5/10 VDC
   c. Indicvidually short circuit protected.

3. Digital Outputs:
   a. Triacs.
   b. LED indication.

C. Units monitor or control each input/output point; process information; and download from the operator station.

D. Stand-alone mode control functions operate regardless of network status. Functions include the following:
   a. Peer to peer primary network level communications with automatic communications loss detection to maintain normal control functionality regardless of available network communications.
   b. Discrete/digital, analog, and pulse input/output.
   c. Monitoring, controlling, or addressing data points.
   d. Appropriate BACnet Objects for specific unitary applications.

E. Local operator interface port located on UEC and UEC sensor provides for download from or upload to portable workstation. All bus devices shall be accessible from either port.

F. Communication: UEC’s shall communicate with the UNC and ACC at a baud rate selectable of 9.6-76.8 Kbaud utilizing MS/TP.

G. UEC units monitor or control each input/output point; process information; and at least 50 expressions for customized HVAC control including mathematical equations, Boolean logic, PID control loops with anti-windup, sequencers, timers, interlocks, thermostats, counters, interlocks, compare, limit, and alarms.

H. All UEC Controller setpoints shall be digital display setpoints with dual setpoint limits (integral hard limits which the user cannot exceed above and below and independent soft limits which are hidden from the user). All digital setpoints shall be network retentive after power outages and after replacement of sensor.

2.19 UEC ROOM SENSORS

A. The UEC Sensor shall provide room temperature value and humidity to the UEC.

B. Each UEC shall support a minimum of two sensors.

C. The UEC Sensor shall connect directly to the controller and shall not utilize any of the I/O points of the controller.

D. The UEC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive.

E. The UEC Sensor shall provide a communications jack for connection to the MS/TP communication trunk to which the UEC controller is connected.

F. The UEC Sensor, the connected controller, and all other devices on the MS/TP bus shall be accessible by the Portable Engineering Station.

G. The UEC Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering.

H. The UEC Sensor shall allow for the customization of the color on the esthetic covering as a standard offering.

I. The UEC Sensor shall be supplied in the following manner:

1. LCD display for showing (typically) the current temperature..
2. Tenant override to allow timed override of unoccupied to occupied mode of operation.
3. LED indication of override state.
4. Up/Down keys to allow adjustment of the current setpoint.
5. User interface with the UEC Sensor shall be provided as a configurable function, and shall offer password protection for access to network variable editing.
6. ASHRAE 95 compliance (LCD display and sub-base functionality)
7. The room sensor shall provide access to additional diagnostic data from a sensor-user keypad request. This Diagnostic mode is displayed on the LCD screens and includes separate displays for the controllers: Submet and Node Address, Errors, Alarms, Temperature Offset.

2.20 CONTROLLER SOFTWARE

A. General:

1. Software applications are to reside and operate in controllers. Edit applications through operator workstations or mobile devices.
2. Identify I/O points by up to 30-character point name and up to 16-character point descriptor. Use same names throughout, including at operator workstations.
3. Execute control functions within controllers using DDC algorithms.
4. Configure controllers to use stored default values to ensure fail-safe operation. Use default values when there is a failure of a connected input instrument or loss of communication of a global point value.

B. Security:

1. Secure operator access using individual security passwords and user names.
2. Passwords restrict operator to points, applications, and system functions as assigned by system manager.
3. Record operator log-on and log-off attempts.
4. Protect from unauthorized use by automatically logging off after last keystroke. Make the delay time operator-definable.

C. Scheduling: Include capability to schedule each point or group of points in system. Each schedule is to consist of the following:

1. Weekly Schedule:

   a. Include separate schedules for each day of week.
   b. Each schedule should include capability for start, stop, optimal start, optimal stop, and night economizer.
   c. Each schedule may consist of up to 10 events.
   d. When a group of objects are scheduled together, include capability to adjust start and stop times for each member.

2. Exception Schedules:

   a. Include ability for operator to designate any day of the year as an exception schedule.
   b. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by regular schedule for that day of week.

3. Holiday Schedules:

   a. Include capability for operator to define up to 99 special or holiday schedules.
   b. Place schedules on scheduling calendar with ability to repeated each year.
   c. Operator able to define length of each holiday period.

D. System Coordination:

1. Include standard application for proper coordination of equipment.
2. Include operator with a method of grouping together equipment based on function and location.
3. Include groups that may be for use in scheduling and other applications.

E. Binary Alarms:

1. Set each binary point to alarm based on operator-specified state.
2. Include capability to automatically and manually disable alarming.

F. Analog Alarms:

1. Provide each analog object with both high and low alarm limits.
2. Include capability to automatically and manually disable alarming.

G. Alarm Reporting:

1. Include ability for operators to determine action to be taken in event of an alarm.
2. Route alarms to appropriate operator workstations based on time and other conditions.

3. Include ability for alarms to start programs, print, be logged in event logs, generate custom messages, and display graphics.

H. Remote Communication:
1. Include ability for system to notify operators by phone message, text message, and email in event of an alarm.

I. Maintenance Management: Monitor equipment status and generate maintenance messages based on operator-designated run-time, starts, and calendar date limits.

J. Sequencing: Include application software based on sequences of operation indicated to properly sequence boilers and other applicable HVAC equipment.

K. Control Loops:

1. Support any of the following control loops, as applicable to control required:

a. Two-position (on/off, open/close, slow/fast) control.
b. Proportional control.
c. Proportional plus integral (PI) control.
d. Proportional plus integral plus derivative (PID) control.

1) Include PID algorithms with direct or reverse action and anti-windup.
2) Algorithm to calculate a time-varying analog value used to position an output or stage a series of outputs.
3) Make controlled variable, set point, and PID gains operator-selectable.

e. Adaptive (automatic tuning).

L. Staggered Start: Prevent all controlled equipment from simultaneously restarting after a power outage. Make the order which equipment (or groups of equipment) is started, along with the time delay between starts, operator-selectable.

M. Energy Calculations:

1. Include software to allow instantaneous power or flow rates to be accumulated and converted to energy usage data.
2. Include algorithm that calculates a sliding-window average (rolling average). Make algorithm flexible to allow window intervals to be operator specified (such as 15, 30, or 60 minutes).
3. Include algorithm that calculates a fixed-window average. Use a digital input signal to define start of window period (such as signal from utility meter) to synchronize fixed-window average with that used by utility.

N. Anti-Short Cycling:

1. Protect BO points from short cycling.
2. Feature to allow minimum on-time and off-time to be selected.

O. On and Off Control with Differential:

1. Include algorithm that allows BO to be cycled based on a controlled variable and set point.
2. Use direct- or reverse-acting algorithm and incorporate an adjustable differential.

P. Run-Time Totalization:

1. Include software to totalize run-times for all BI and BO points.
2. Assign a high run-time alarm, if required, by operator.

2.21 ENCLOSURES

A. General:

1. House each controller and associated control accessories in single enclosure. Enclosure is to serve as central tie-in point for control devices such as switches, transmitters, transducers, power supplies, and transformers.
2. Do not house more than one controller in single enclosure.
3. Include enclosure door with key locking mechanism. Key locks alike for all enclosures and include one pair of keys per enclosure.
4. Equip doors of enclosures housing controllers and components with analog or digital displays with windows to allow visual observation of displays without opening enclosure door.
5. Individual, wall-mounted, single-door enclosures maximum of 36 inches wide and 48 inches high.
6. Individual, wall-mounted, double-door enclosures maximum of 60 inches wide and 36 inches high.
7. Include wall-mounted enclosures with brackets suitable for mounting enclosures to wall or freestanding support stand as indicated.
8. Supply each enclosure with complete set of as-built schematics, tubing, and wiring diagrams and product literature located in pocket on inside of door. For enclosures with windows, include pocket on bottom of enclosure.

B. Internal Arrangement:

1. Arrange internal layout of enclosure to group and protect electric, and electronic components associated with controller, but not an integral part of controller.
2. Arrange layout to group similar products together.
3. Include a barrier between line-voltage and low-voltage electrical and electronic products.
4. Factory or shop install products, tubing, cabling, and wiring complying with requirements and standards indicated.
5. Terminate field cable and wire using heavy-duty terminal blocks.
6. Include spare terminals, equal to not less than 10 percent of used terminals.
7. Include spade lugs for stranded cable and wire.
8. Install maximum of two wires on each side of terminal.
9. Include enclosure field electric power supply with toggle-type switch located at entrance inside enclosure to disconnect power.
10. Include enclosure with line-voltage nominal 20 A GFCI duplex receptacle for service and testing tools. Wire receptacle on hot side of enclosure disconnect switch and include with 5 A circuit breaker.
11. Mount products within enclosure on removable internal panel(s).
12. Include products mounted in enclosures with engraved, laminated phenolic nameplates (black letters on a white background). Nameplates are to have at least 1/4-inch-high lettering.
13. Route tubing cable and wire located inside enclosure within a raceway with continuous removable cover.

14. Label each end of cable, wire, and tubing in enclosure following an approved identification system that extends from field I/O connection and all intermediate connections throughout length to controller connection.
15. Size enclosure internal panel to include at least 15 percent spare area on face of panel.

C. Environmental Requirements:

1. Evaluate temperature and humidity requirements of each product to be installed within each enclosure.
2. Calculate enclosure internal operating temperature considering heat dissipation of all products installed within enclosure and ambient effects (solar, conduction, and wind) on enclosure.
3. Where required by application, include temperature-controlled electrical heat to maintain inside of enclosure above minimum operating temperature of product with most stringent requirement.
4. Where required by application, include temperature-controlled ventilation fans with filtered louver(s) to maintain inside of enclosure below maximum operating temperature of product with most stringent requirement.
5. Include temperature-controlled cooling within the enclosure for applications where ventilation fans cannot maintain inside temperature of enclosure below maximum operating temperature of product with most stringent requirement.
6. Where required by application, include humidity-controlled electric dehumidifier or cooling to maintain inside of enclosure below maximum relative humidity of product with most stringent requirement and to prevent surface condensation within enclosure.

D. Wall-Mounted, NEMA 250, Type 1:

1. NRTL listed in accordance with UL 50 or UL 50E.
2. Construct enclosure of steel, not less than the following:

    a. Enclosure Size Less Than 24 Inches: 0.053 inch or 0.067 inch thick.
    b. Enclosure Size 24 Inches and Larger: 0.067 inch or 0.093 inch thick.

3. Finish enclosure inside and out with polyester powder coating that is electrostatically applied and then baked to bond to substrate.

    a. Exterior Color: Manufacturer's standard.
    b. Interior Color: Manufacturer's standard.

4. Hinged door full size of front face of enclosure and supported using the following:

    a. Enclosures Sizes Less Than 36 Inches Tall: Multiple butt hinges.
    b. Enclosures Sizes 36 Inches Tall and Larger: Continuous piano hinges.

5. Removable internal panel with white or gray polyester powder coating that is electrostatically applied and then baked to bond to substrate.

    a. Size Less Than 24 Inches: Solid or perforated steel, 0.053 inch thick.
    b. Size 24 Inches and Larger: Solid aluminum, 0.10 inch or steel, 0.093 inch thick.

6. Internal panel mounting hardware, grounding hardware, and sealing washers.
7. Grounding stud on enclosure body.
8. Thermoplastic pocket on inside of door for record Drawings and Product Data.

E. Wall-Mounted, NEMA 250, Types 4 and 12:
1. NRTL listed in accordance with UL 508A.
2. Seam and joints are continuously welded and ground smooth.
3. Where recessed enclosures are indicated, include enclosures with face flange for flush mounting.
4. Externally formed body flange around perimeter of enclosure face for continuous perimeter seamless gasket door seal.
5. Single-door enclosure sizes up to 60 inches tall by 36 inches wide.
6. Double-door enclosure sizes up to 36 inches tall by 60 inches wide.
7. Construct enclosure of steel, not less than the following:

a. Size Less Than 24 Inches: 0.053 inch or0.067 inch thick.
b. Size 24 Inches and Larger: 0.067 inch thick.

8. Finish enclosure with polyester powder coating that is electrostatically applied and then baked to bond to substrate.

a. Exterior Color: Manufacturer's standard.
b. Interior Color: Manufacturer's standard.

9. Corner-formed door, full size of enclosure face, supported using multiple concealed hinges with easily removable hinge pins.

a. Sizes through 24 Inches Tall: Two hinges.
b. Sizes between 24 Inches through 48 Inches Tall: Three hinges.
c. Sizes Larger Than 48 Inches Tall: Four hinges.

10. Double-door enclosures with overlapping door design to include unobstructed full-width access.

a. Single-door enclosures 48 inches and taller, and all double-door enclosures, with three-point (top, middle and bottom) latch system.

11. Removable internal panel with white or graypolyester powder coating that is electrostatically applied and then baked to bond to substrate.

a. Size Less Than 24 Inches: Solid or perforatedsteel, 0.053 inch thick.
b. Size 24 Inches and Larger: Solid aluminum, 0.10 inch or steel, 0.093 inch thick.

12. Internal panel mounting studs with hardware, grounding hardware, and sealing washers.
13. Grounding stud on enclosure body.
14. Thermoplastic pocket on inside of door for record Drawings and Product Data.

F. Accessories:

1. Electric Heater:

a. Aluminum housing with brushed finish.
b. Thermostatic control with adjustable set point from 0 to 100 deg F.
c. Capacity: 100, 200, 400, and 800 W, as required by application.
d. Fan draws cool air from bottom of enclosure and passes air across thermostat and heating elements before being released into enclosure cavity. Heated air is discharged through the top of heater.

2. Ventilation Fans, Filtered Intake, and Exhaust Grilles:

   a. Number and size of fans, filters, and grilles, as required by application.
   b. Compact cooling fans engineered for 50,000 hours of continuous operation without lubrication or service.
   c. Fans capable of being installed on any surface and in any position within enclosure for spot cooling or air circulation.
   d. Thermostatic control with adjustable set point from 32 to 140 deg F.
   e. Airflow Capacity at Zero Pressure:

      1) 4-Inch Fan: 100 cfm.
      2) 6-Inch Fan: 240 cfm.
      3) 10-Inch Fan: 560 cfm.

   f. Maximum operating temperature of 158 deg F.
   g. 4-inch fan thermally protected and provided with permanently lubricated ball-bearings.
   h. 6- and 10-inch fans with ball-bearing construction and split capacitor motors thermally protected to avoid premature failure.
   i. Dynamically balanced impellers molded from polycarbonate material.
   j. Fan furnished with power cord and polarized plug for power connection.
   k. Fan brackets, finger guards, and mounting hardware provided with fans to complete installation.
   l. Removable Intake and Exhaust Grilles: ABS plastic or stainless steel, of size to match fan size and suitable for NEMA 250, Types 1 and 12 enclosures.
   m. Filters for NEMA 250, Type 1 Enclosures: Washable foam or aluminum, of size to match intake grille.
   n. Filters for NEMA 250, Type 12 Enclosures: Disposable, of size to match intake grille.

2.22 RELAYS

A. General-Purpose Relays:
   1. NRTL listed.
   2. Heavy-duty, electromechanical type; rated for at least 10 A at 250 V ac and 60 Hz.
   3. SPDT, DPDT, or three-pole double-throw, as required by control application.
   4. Plug-in-style relay with 8-pin octal or multiblade plug for DPDT relays and 11-pin octal or multiblade plug for three-pole double-throw relays.
   5. Construct contacts of silver, silver alloy, or gold.
   6. Enclose relay in a clear transparent polycarbonate dust-tight cover.
   7. Include LED indication and push-to-test button to test manual operation of relay without power on coil.
   8. Performance:

      a. Mechanical Life: At least 10 million cycles.
      b. Electrical Life: At least 100,000 cycles at rated load.
      c. Pickup Time: 15 ms or less.
      d. Dropout Time: 10 ms or less.
      e. Pull-in Voltage: 85 percent of rated voltage.
      f. Dropout Voltage: 50 percent of nominal rated voltage.
      g. Power Consumption: 2 VA or less.
      h. Ambient Operating Temperatures: Minus 40 to 115 deg F.

9. Equip relays with coil transient suppression to limit transients to non-damaging levels.
10. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
11. Include relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

B. Multifunction Time-Delay Relays:
1. NRTL listed.
2. Continuous-duty type, rated for at least 10 A at 240 V ac and 60 Hz.
3. Relay with up to 4 programmable functions to provide on/off delay, interval, and recycle timing functions.
4. Plug-in-style relay with either multi-pin or blade plug.
5. Construct contacts of silver, silver alloy, or gold.
6. Enclose relay in a dust-tight cover.
7. Include knob and dial scale for alternative digital interface for setting delay time.
8. Visual Status Indication: Power "On" and Output "On" status.
9. Performance:

    a. Mechanical Life: At least 10 million cycles.
    b. Electrical Life: At least 100,000 cycles at rated load.
    c. Timing Ranges: Multiple ranges from 0.1 seconds to 100 minutes.
    d. Repeatability: Within 2 percent.
    e. Recycle Time: 45 ms.
    f. Minimum Pulse-Width Control: 50 ms.
    g. Power Consumption: 5 VA or less.
    h. Ambient Operating Temperatures: Minus 40 to 115 deg F.

10. Equip relays with transient suppression to limit transients to non-damaging levels.
11. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
12. Include relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

C. Latching Relays:
1. NRTL listed.
2. Continuous-duty type, rated for at least 10 A at 250 V ac and 60 Hz.
3. SPDT, DPDT, or three-pole double-throw, as required by control application.
4. Plug-in-style relay with either multi-pin or blade plug.
5. Construct contacts of silver, silver alloy, or gold.
6. Enclose relay in a clear transparent polycarbonate dust-tight cover.
7. Performance:

    a. Mechanical Life: At least 10 million cycles.
    b. Electrical Life: At least 100,000 cycles at rated load.
    c. Pickup Time: 15 ms or less.
    d. Dropout Time: 10 ms or less.
    e. Pull-in Voltage: 85 percent of rated voltage.
    f. Dropout Voltage: 50 percent of nominal rated voltage.
    g. Power Consumption: 2 VA or less.
    h. Ambient Operating Temperatures: Minus 40 to 115 deg F.

8. Equip relays with coil transient suppression to limit transients to non-damaging levels.
9. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.

10. Relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

D. Current Sensing Relays:
1. NRTL listed.
2. Monitors ac current.
3. Independent adjustable controls for pickup and dropout current.
4. Energized when supply voltage is present and current is above pickup setting.
5. De-energizes when monitored current is below dropout current.
6. Dropout current is adjustable from 50 to 95 percent of pickup current.
7. Visual indication of contact status.
8. Include current transformer, if required for application.
9. House current sensing relay and current transformer if required in its own enclosure. Use NEMA 250, Type 1 or Type 12 enclosure for indoors applications and NEMA 250, Type 4 or Type 4X for outdoor applications.

E. Combination On-Off Status Sensor and On-Off Control Relays:
1. Description:

a. On-off control and on-off status indication in a single device.
b. LED status indication of activated relay and current trigger.
c. Closed-Open-Auto override switch located on the load side of relay.

2. Performance:

a. Ambient Temperature: Minus 30 to 140 deg F.
b. Voltage Rating: Single-phase loads rated for 300 V ac. Three-phase loads rated for 600 V ac.

3. Status Indication:

a. Current Sensor: Integral sensing for single-phase loads up to 20 A and external solid or split sensing ring for three-phase loads up to 150 A.
b. Current Sensor Range: As required by application.
c. Current Set Point: Fixed or adjustable, as required by application.
d. Current Sensor Output:

1) Solid-state, SPDT contact rated for 30 V ac and dc and for 0.4 A.
2) Solid-state, SPDT contact rated for 120 V ac and 1.0 A.
3) Analog, 0 to 5 or 10 V dc.
4) Analog, 4 to 20 mA, loop powered.

4. Relay: SPDT, continuous-duty coil; rated for 10-million mechanical cycles.
5. Enclosure: NEMA 250, Type 1 enclosure for indoor applications; NEMA 250, Type 4 enclosure for outdoor applications.

2.23 ELECTRICAL POWER DEVICES

A. Control Transformers:

1. Sizing Criteria: Size control transformers for total connected load, plus additional 25 percent of connected load for future spare capacity.
2. Transformer Minimum Capacity: 40 VA.

3. Protection: Provide transformers with both primary and secondary fuses. Integral circuit breaker is acceptable in lieu of fuses.
4. Enclosure: House control transformers in NEMA 250 enclosures, type as indicated in "Performance Requirements" Article for application.

B. DC Power Supplies:
1. Description: Linear or switched, regulated power supplies with ac input to one or multipledc output(s).

a. Include both line and load regulation to ensure stable output.
b. To protect both power supply and load, include power supply with an automatic current limiting circuit.

2. Features:

a. Connection: Plug-in style suitable for mating with standard 8-pin octal socket. Include power supply with mating mounting socket.
b. Housing: Enclose circuitry in a housing.
c. Local Adjustment: Include screw adjustment on exterior of housing for dc voltage output.
d. Mounting: DIN rail.
e. Visual status indicator. f.

3. Performance:

a. Input Voltage: Nominally 120 V ac, 60 Hz.
b. Output Voltage: Nominally 24 V dc with plus or minus 1 V dc adjustment.
c. Output Current: Minimum 100 mA.
d. Load Regulation: Within 0.1 percent.
e. Line Regulation: Within 0.05 percent.
f. Stability: Within 0.1 percent of rated volts after warmup period.
g. Ripple: 1 mV rms.

2.24 UNINTERRUPTABLE POWER SUPPLY (UPS) UNITS

A. Furnish local UPS units, of type indicated, installed with DDC system.

B. DIN Rail Mounted UPS:
1. Provide continuous, regulated output power without using batteries during brown-out, surge, and spike conditions.
2. Performance:

a. Capacity: Load not to exceed 75 percent of rated capacity.
b. Efficiency: Minimum 94 percent.
c. Input Voltage: Single phase, 120 V ac, compatible with field power source.
d. Load Power Factor Range (Crest Factor): 0.65 to 1.0.
e. Output Voltage: 101 to 132 V ac, while input voltage varies between 89 and 152 V ac.
f. On Battery Output Voltage: Sine wave.
g. Inverter Overload Capacity: Minimum 150 percent for 30 seconds.
h. Battery Backup: 10 minutes of operation at full load with battery power.

i. Battery Recharge Time: Maximum of four hours to 90 percent capacity after full discharge.
j. Transfer Time: 6 ms.
k. Surge Voltage Withstand Capacity: IEEE C62.41.1 and IEEE C62.41.2, Categories A and B.

3. Automatic bypass operation during fault or overload conditions.
4. Integral line-interactive, power condition topology to eliminate all power contaminants.
5. Include power switch and visual indication of power, battery, fault, and temperature.
6. Include audible alarm of faults with silence feature.
7. Include dry contacts (digital output points) for low battery condition and battery-on (primary utility power failure) and connect points to DDC system.
8. Batteries: Sealed; maintenance free; replacement without dropping load.

C. Tower UPS Models through 1000 VA:

a. APC by Schneider Electric.
b. Eaton.

2. Provide continuous, regulated output power without using batteries during brown-out, surge, and spike conditions.
3. Performance:

a. Capacity: Load not to exceed 75 percent of rated capacity.
b. Efficiency: Complying with ENERGY STAR requirements; minimum 91 percent.
c. Input Voltage: Single phase, 120 V ac, compatible with field power source.
d. Load Power Factor Range (Crest Factor): 0.65 to 1.0.
e. Output Voltage: 101 to 132 V ac, while input voltage varies between 89 and 152 V ac.
f. On Battery Output Voltage: Sine wave.
g. Inverter Overload Capacity: Minimum 150 percent for 30 seconds.
h. Battery Backup: 10 minutes of operation at full load with battery power.
i. Battery Recharge Time: Maximum of four hours to 90 percent capacity after full discharge to cutoff.
j. Transfer Time: 0 ms.
k. Surge Voltage Withstand Capacity: IEEE C62.41.1 and IEEE C62.41.2, Categories A and B; 6 kV/200 and 500 A; 100 kHz ring wave.

4. Automatic bypass operation during fault or overload conditions.
5. Integral line-interactive, power condition topology to eliminate all power contaminants.
6. Include power switch and visual indication of power, battery, fault, and temperature.
7. Include audible alarm of faults and front panel silence feature.
8. Receptacles: Minimum four, NEMA WD 1, NEMA WD 6 Configuration 5-15R receptacles.
9. Remote Alarms: Include dry contacts (digital output points) or serial communication interface for low battery condition and battery-on (primary utility power failure) and connect points to DDC system.
10. Batteries: Sealed type; maintenance free. Battery replacement is to be front accessible by user without dropping load.
11. Install tower models in enclosures rated for location.

D. Tower and Rack UPS Models through 3000 VA:
1. NRTL Listing: UL 1778.
2. Provide continuous, regulated output power without using batteries during brown-out, surge, and spike conditions.

3. Performance:

   a. Capacity: Load not to exceed 75 percent of UPS rated capacity.
   b. Efficiency: Complying with ENERGY STAR requirements; minimum 91 percent.
   c. Input Voltage: Single phase, 120 V ac, plus 20 to minus 30 percent.
   d. Power Factor: Minimum 0.95 at full load.
   e. Output Voltage: Single phase, 120 V ac, within 2 percent.
   f. Inverter overload capacity to be minimum 150 percent for 30 seconds.
   g. Battery Backup: 10 minutes of operation at full load with battery power.
   h. Battery Recharge Time: Maximum of 6 hours to 90 percent capacity.
   i. Transfer Time: 0 ms.

4. LCD display with operator interface.
5. Receptacles: Minimum 6, NEMA WD 1, NEMA WD 6 Configuration 5-15R or 5-20R receptacles.
6. Automatic bypass operation during fault or overload conditions.
7. Remote Alarms: Include dry contacts (digital output points) or serial communication interface for low battery condition and battery-on (primary utility power failure) and connect points to DDC system.
8. Batteries: Sealed; maintenance free.
9. Enclosures: Install tower models in enclosures rated for location. Install rack models installed on matching racks, as applicable to particular installation location and space availability/configuration.

2.25 CONTROL WIRE AND CABLE

A. Wire: Single conductor control wiring above 24 V.

1. Wire Size: Minimum 18 AWG.
2. Conductors: 7/24 soft annealed copper strand with 2- to 2.5-inch lay.
3. Conductor Insulation: 600 V, Type THWN or Type THHN, and 90 deg C in accordance with UL 83.
4. Conductor Insulation Colors: Black (hot), white (neutral), and green (ground).
5. Furnish on spools.

B. Single, Twisted-Shielded, Instrumentation Cable above 24 V:

1. Wire Size: Minimum 18 AWG.
2. Conductors: Twisted, 7/24 soft annealed copper strand with a 2- to 2.5-inch lay.
3. Conductor Insulation: Type THHN/THWN or Type TFN rating.
4. Conductor Insulation Colors:

   a. Twisted Pair: Black and white.
   b. Twisted Triad: Black, red, and white.

5. Shielding: 100 percent type, 0.35/0.5-mil aluminum/Mylar tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
6. Outer Jacket Insulation: 600 V, 90 deg C rating, and Type TC cable.
7. Furnish on spools.

C. Single, Twisted-Shielded, Instrumentation Cable 24 V and Less:

1. Wire Size: Minimum 18 AWG.
2. Conductors: Twisted, 7/24 soft annealed copper stranding with a 2- to 2.5-inch lay.
3. Conductor Insulation: Nominal 15-mil thickness, constructed from flame-retardant PVC.
4. Conductor Insulation Colors:

    a. Twisted Pair: Black and white.
    b. Twisted Triad: Black, red, and white.

5. Shielding: 100 percent type, 1.35-mil aluminum/polymer tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
6. Outer Jacket Insulation: 300 V, 105 deg C rating, and Type PLTC cable.
7. Furnish on spools.

D. LAN and Communication Cable: Comply with DDC system manufacturer requirements for network being installed.

1. Comply with following requirements for balanced twisted pair cable described in Section 260523 "Control-Voltage Electrical Power Cables."

    a. Plenum rated.
    b. Unique color that is different from other cables used on Project.

2.26 RACEWAYS

A. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for electrical power raceways and boxes.
1. Exposed conduit in mechanical room – rigid conduit
2. Exposed conduit throughout school except mechanical room – EMT conduit
3. Concealed conduit in inaccessible areas – Flexible Metallic Conduit
4. Wiremold is not permitted in any application.

B. Comply with requirements in Section 270500 "Telecom Infrastructure" for raceways for balanced twisted pair cables and optical fiber cables. No plenum cable or other signal wiring is allowed. All signal and power wiring must be in metallic raceways.

2.27 OPTICAL FIBER CABLE AND CONNECTORS

A. Comply with requirements in Section 271000 "Telecommunication Cabling" for optical fiber cabling and connectors.

2.28 IDENTIFICATION

A. Control Equipment, Instruments, and Control Devices:

1. Laminated acrylic or melamine plastic sign bearing unique identification.

    a. Include instruments with unique identification identified by equipment being controlled or monitored, followed by point identification.

2. Letter size as follows:

a. Servers: Minimum of 0.5 inch high.
b. DDC Controllers: Minimum of 0.5 inch high.
c. Gateways: Minimum of 0.5 inch high.
d. Repeaters: Minimum of 0.5 inch high.
e. Enclosures: Minimum of 0.5 inch high.
f. Electrical Power Devices: Minimum of 0.25 inch high.
g. UPS units: Minimum of 0.5 inch high.
h. Accessories: Minimum of 0.25 inch high.
i. Instruments: Minimum of 0.25 inch high.
j. Control Damper and Valve Actuators: Minimum of 0.25 inch high.

3. Engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers color-coded black with contrasting white center exposed by engraving through outer layer.
4. Fastened with drive pins.
5. Instruments, control devices, and actuators with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require additional identification.

B. Valve Tags:

1. Brass tags and brass chains attached to valve.
2. Tag Size: Minimum 1.5 inches in diameter.
3. Include tag with unique valve identification indicating control influence such as flow, level, pressure, or temperature; followed by location of valve, and followed by three-digit sequential number. For example: TV-1.001.
4. Valves with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require an additional tag.

C. Raceway and Boxes:

1. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
2. Paint cover plates on junction boxes and conduit same color as tape banding for conduits. After painting, label cover plate "HVAC Controls" using engraved phenolic tag.

D. Equipment Warning Labels:

1. Self-adhesive label with pressure-sensitive adhesive back and peel-off protective jacket.
2. Lettering size at least 14-point type with white lettering on red background.
3. Warning label to read "CAUTION-Equipment operated under remote automatic control and may start or stop at any time without warning. Switch electric power disconnecting means to OFF position before servicing."
4. Lettering to be enclosed in a white line border. Edge of label is to extend at least 0.25 inch beyond white border.

2.29 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate the following in accordance with industry standards for each product, and to verify DDC system reliability specified in performance requirements:

1. DDC controllers.
2. Gateways.
3. Routers.

B. Product(s) and material(s) will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DDC SYSTEM INTERFACE WITH OTHER SYSTEMS AND EQUIPMENT

A. Communication Interface to Equipment with Integral Controls:

1. DDC system has communication interface with equipment having integral controls and having communication interface for remote monitoring or control.
2. Equipment to Be Connected:

    a. Boilers specified in Section 235216 "Condensing Boilers."
    b. Air cooled chillers in Section 236423 “Air-Cooled, Scroll Water Chillers.”
    c. Air-handling units specified in Section 238219 "Indoor Air-Handling Units."
    d. Roof-top units & DOAS Units specified in Section 237413 "Packaged, Outdoor, Central-Station Air-Handling Units."
    e. Variable refrigerant flow units specified in Section 238127 "Variable-Refrigerant-Flow HVAC Systems."

3.2 PREINSTALLATION INTEGRATION TESTING

A. Perform the following pretesting of other systems and equipment integration with DDC system before field installation:

1. Test all communications in a controlled environment to ensure connectivity.
2. Load software and demonstrate functional compliance with each control sequence of operation indicated.
3. Using simulation, demonstrate compliance with sequences of operation and other requirements indicated including, but not limited to, the following:

    a. HVAC equipment controlled through DDC system, such as boilers, pumps, and air-handling units.
    b. Equipment faults and system recovery with fault annunciation.
    c. Analog and Boolean value alarming and annunciation.

4. Develop a method for testing interfaces before deployment.
5. Submit documentation supporting compliance upon request.

3.3 CONTROL DEVICES FOR INSTALLATION BY INSTALLERS

A. Deliver selected control devices, specified in indicated HVAC instrumentation and control device Sections, to identified equipment and systems manufacturers for factory installation and to identified installers for field installation.

B. Deliver the following to duct fabricator and Installer for installation in ductwork. Include installation instructions to Installer and supervise installation for compliance with requirements.

1. Control dampers, which are specified in Section 230930 "HVAC Instrumentation."

C. Deliver the following to plumbing and HVAC piping installers for installation in piping. Include installation instructions to Installer and supervise installation for compliance with requirements.

1. Control valves, which are specified in Section 230930 "HVAC Instrumentation."
2. Pipe-mounted sensors, switches, and transmitters. Flow meters are specified in Section 230930 "HVAC Instrumentation."

3.4 GENERAL INSTALLATION REQUIREMENTS

A. Install products to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Support products, tubing, piping wiring, and raceways. Brace products to prevent lateral movement and sway.

D. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.

E. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

F. Firestop Penetrations Made in Fire-Rated Assemblies: Comply with requirements in Division 07 Section "Firestops and Smokeseals."~~Section 078413 "Penetration Firestopping."~~

G. Seal penetrations made in acoustically rated assemblies. Comply with requirements in Section 079200 "Joint Sealants."

H. Welding Requirements:

1. Restrict welding and burning to supports and bracing.
2. No equipment is cut or welded without approval. Welding or cutting will not be approved if there is risk of damage to adjacent Work.
3. Welding, where approved, is to be by inert-gas electric arc process and is to be performed by qualified welders in accordance with applicable welding codes.
4. If requested on-site, show satisfactory evidence of welder certificates indicating ability to perform welding work intended.

I. Fastening Hardware:

1. Wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

J. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

3.5 INSTALLATION OF WORKSTATIONS

A. Desktop Workstation Installation:

1. Install workstation(s) at location(s) indicated on Drawings.
2. Install multiple-receptacle power strip with cord for use in connecting multiple workstation components to a single, duplex, electrical power receptacle.
3. Install DDC system software on workstation(s) and verify that software functions properly.
4. Develop Project-specific graphics, trends, reports, logs, and historical database.
5. Power each workstation through a dedicated UPS unit. Locate UPS adjacent to workstation.

B. Color Graphics Application:

1. Use system schematics indicated on Drawings as starting point to create graphics.
2. Develop Project-specific library of symbols for representing system equipment and products.
3. Incorporate digital images of Project-completed installation into graphics where beneficial to enhance effect.
4. Submit sketch of graphic layout with description of all text for each graphic for Owner's and Architect's review before creating graphic using graphics software.
5. Seek Owner input in graphics development once using graphics software.
6. Make final editing on-site with Owner's and Architect's review and feedback.
7. Refine graphics as necessary for Owner acceptance.
8. On receiving Owner acceptance, print a PDF file of each graphic and include with softcopy of DDC system operation and maintenance manual.

3.6 INSTALLATION OF SERVERS

A. Install server(s) at location(s) indicated on Drawings.

B. Install number of servers required to suit requirements indicated. Review Project requirements and indicate layout of proposed server location in Shop Drawings.

C. Install software indicated on server(s) and verify that software functions properly.

D. Develop Project-specific graphics, trends, reports, logs, and historical database.

E. Power servers through dedicated UPS unit. Locate UPS adjacent to server. Install rack- mounted UPS units for powering rack-mounted servers and tower UPS units for tower servers.

3.7 INSTALLATION OF GATEWAYS

A. Install gateways if required for DDC system communication interface requirements indicated.

1. Install gateway(s) required to suit indicated requirements.

B. Test gateways to verify that communication interface functions properly.

3.8 INSTALLATION OF ROUTERS

A. Install routers if required for DDC system communication interface requirements indicated.

1. Install router(s) required to suit indicated requirements.

B. Test routers to verify that communication interface functions properly.

3.9 INSTALLATION OF CONTROLLERS

A. Install controllers in enclosures to comply with indicated requirements.

B. Connect controllers to field power supply and to UPS units where indicated.

C. Install controllers with latest version of applicable software and configure to execute requirements indicated.

D. Test and adjust controllers to verify operation of connected I/O to achieve performance indicated requirements while executing sequences of operation.

E. Installation of Network Controllers:

1. DDC system provider and DDC system manufacturer to determine quantity and location of network controllers to satisfy requirements indicated. Provide minimum quantity indicated.
2. Install controllers in a protected location that is easily accessible by operators.
3. Locate top of controller within 72 inches of finished floor.

F. Installation of Programmable Application Controllers:

1. DDC system provider and DDC system manufacturer to determine quantity and location of programmable application controllers to satisfy requirements indicated. Provide minimum quantity indicated.
2. Install controllers in a protected location that is easily accessible by operators.
3. Locate top of controller within 72 inches of finished floor, except where dedicated controllers are installed at terminal units.

G. Application-Specific Controllers:

1. DDC system provider and DDC system manufacturer to determine quantity and location of application-specific controllers to satisfy requirements indicated. Provide minimum quantity indicated.
2. For controllers not mounted directly on equipment being controlled, install controllers in a protected location that is easily accessible by operators.

3.10 INSTALLATION OF ENCLOSURES

A. Install the following items in enclosures, to comply with indicated requirements:

1. Gateways.
2. Routers.
3. Controllers.
4. Electrical power devices.
5. UPS units.
6. Relays.
7. Accessories.
8. Instruments.
9. Actuators.

B. Attach wall-mounted enclosures to wall using the following types of steel struts:

1. For NEMA 250, Type 1 Enclosures: Use painted steel strut and hardware.
2. For NEMA 250, Type 4 Enclosures and Enclosures Located Outdoors: Use stainless steel strut and hardware.
3. Install plastic caps on exposed cut edges of strut.

C. Align top or bottom of adjacent enclosures of like size.

D. Install floor-mounted enclosures located in mechanical equipment rooms on concrete housekeeping pads. Attach enclosure legs using galvanized-steel or stainless steel anchors.

E. Install continuous and fully accessible wireways to connect conduit, wire, and cable to multiple adjacent enclosures. Wireways used for application are to have protection equal to NEMA 250 rating of connected enclosures.

3.11 ELECTRIC POWER CONNECTIONS

A. Connect electrical power to DDC system products requiring electrical power connections. DDC system provided is responsible for all power wiring from designated circuit in panelboard, through conduit to control devices, including 120V circuits, transformers, and low voltage wiring.

B. Design of electrical power to products not indicated with electric power is delegated to DDC system provider and installing trade to provide a fully functioning DDC system. Work is to comply with NFPA 70 and other requirements indicated.

C. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers" for electrical power circuit breakers.

D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power conductors and cables.

E. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for electrical power raceways and boxes.

3.12 INSTALLATION OF IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identification products and installation.

B. Install laminated acrylic or melamine plastic signs with unique identification on face for each of the following:

1. Server.
2. Gateway.
3. Router.
4. DDC controller.
5. Enclosure.
6. Electrical power device.
7. UPS unit.
8. Accessory.

C. Install unique instrument identification for each instrument connected to DDC controller.

D. Install unique identification for each control damper and valve actuator connected to DDC controller.

E. Where product is installed above accessible tile ceiling, also install matching identification on face of ceiling grid located directly below.

F. Where product is installed above an inaccessible ceiling, also install identification on face of access door directly below.

G. Warning Labels and Signs:

1. Permanently attach to equipment that can be automatically started by DDC control system.
2. Locate where highly visible near power service entry points.

3.13 INSTALLATION OF NETWORKS

A. Install optical fiber cable when connecting between the following network devices and when located in different buildings on campus:

1. Operator workstations.
2. Operator workstations and network controllers.
3. Network controllers.

B. Install balanced twisted pair or optical fiber cable when connecting between the following network devices located in same building:

1. Operator workstations.
2. Operator workstations and network controllers.
3. Network controllers.

C. Install balanced twisted pair or copper cable (as required by equipment) when connecting between the following:

1. Gateways.
2. Gateways and network controllers or programmable application controllers.
3. Routers.
4. Routers and network controllers or programmable application controllers.
5. Network controllers and programmable application controllers.
6. Programmable application controllers.
7. Programmable application controllers and application-specific controllers.
8. Application-specific controllers.

D. Install cable in continuous raceway.

1. Where indicated on Drawings, cable trays may be used for copper cable in lieu of conduit.

3.14 NETWORK NAMING AND NUMBERING

A. Coordinate with Owner and provide unique naming and addressing for networks and devices.

B. ASHRAE 135 Networks:

1. MAC Address:

a. Assign and document a MAC address unique to its network for every network device.
b. Ethernet Networks: Document MAC address assigned at its creation.
c. MS/TP Networks: Assign from 00 to 64.

2. Network Numbering:

a. Assign unique numbers to each new network.
b. Provide ability for changing network number through device switches or operator interface.
c. DDC system, with all possible connected LANs, can contain up to 65,534 unique networks.

3. Device Object Identifier Property Number:

a. Assign unique device object identifier property numbers or device instances for each device network.
b. Provide for future modification of device instance number by device switches or operator interface.
c. LAN is to support up to 4,194,302 unique devices.

4. Device Object Name Property Text:

a. Device object name property field to support 32 minimum printable characters.
b. Assign unique device "Object Name" property names with plain-English descriptive names for each device.

1) Example 1: Device object name for device controlling heating water boiler plant at Building 1000 would be "Heating Water System Bldg. 1000."
2) Example 2: Device object name for VAV terminal unit controller could be "VAV Unit 102."

5. Object Name Property Text for Other Than Device Objects:

a. Object name property field is to support 32 minimum printable characters.
b. Assign object name properties with plain-English names descriptive of application.

1) Example 1: "Zone 1 Temperature."
2) Example 2 "Fan Start and Stop."

6. Object Identifier Property Number for Other Than Device Objects:

    a. Assign object identifier property numbers according to Drawing sor tables indicated.
    b. If not indicated, object identifier property numbers may be assigned at Installer's discretion but must be approved by Owner in advance, be documented, and be unique for like object types within device.

3.15 INSTALLATION OF CONTROL WIRE, CABLE, AND RACEWAY

A. Comply with NECA 1.

B. Wire and Cable Installation:

1. Comply with installation requirements in Section 260523 "Control-Voltage Electrical Power Cables."
2. Comply with installation requirements in Section 271313 "Communications Copper Backbone Cabling."
3. Comply with installation requirements in Section 271513 "Communications Copper Horizontal Cabling."
4. Install cables with protective sheathing that is waterproof and capable of withstanding continuous temperatures of 90 deg C with no measurable effect on physical and electrical properties of cable.

    a. Provide shielding to prevent interference and distortion from adjacent cables and equipment.

5. Terminate wiring in a junction box.

    a. Clamp cable over jacket in a junction box.
    b. Individual conductors in the stripped section of cable is to be slack between the clamping point and terminal block.

6. Terminate field wiring and cable not directly connected to instruments and control devices having integral wiring terminals using terminal blocks.
7. Install signal transmission components in accordance with IEEE C2, REA Form 511a, NFPA 70, and as indicated.
8. Use shielded cable to transmitters.
9. Use shielded cable to temperature sensors.
10. Perform continuity and meager testing on wire and cable after installation.

C. Conduit Installation:

1. Comply with Section 260533 "Raceway and Boxes for Electrical Systems" for control-voltage conductors.
2. Comply with Section 270528 "Pathways for Communications Systems" for balanced twisted pair cabling and optical fiber installation.

3.16 INSTALLATION OF OPTICAL FIBER CABLE SYSTEMS

A. Comply with installation requirements in Section 271323 "Communications Optical Fiber Backbone Cabling."

B. Comply with installation requirements in Section 271523 "Communications Optical Fiber Horizontal Cabling."

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Optical Fiber Cable Testing:

1. Perform preinstallation, in-progress, and final tests, supplemented by additional tests, as necessary.
2. Preinstallation Cable Verification: Verify integrity and serviceability for new cable lengths before installation. This assurance may be provided by using vendor verification documents, testing, or other methods. At a minimum, furnish evidence of verification for cable attenuation and bandwidth parameters.
3. In-Progress Testing: Perform standard tests for correct pair identification and termination during installation to ensure proper installation and cable placement. Perform tests in addition to those specified if there is any reason to question condition of material furnished and installed. Testing accomplished is to be documented by agency conducting tests. Submit test results for Project record.
4. Final Testing: Perform final test of installed system to demonstrate acceptability as installed. Perform testing according to test plan supplied by DDC system manufacturer. Correct defective Work or material and retest. At a minimum, final testing for cable system, including spare cable, to verify compliance of attenuation, length, and bandwidth parameters with performance indicated.
5. Test Equipment: Use optical fiber time-domain reflectometer for testing of length and optical connectivity.
6. Test Results: Record test results and submit copy of test results for Project record.

3.18 DDC SYSTEM I/O CHECKOUT PROCEDURES

A. Check installed products before continuity tests, leak tests, and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.

E. Control Damper Checkout:
1. Verify that control dampers are installed correctly for flow direction.
2. Verify that proper blade alignment, either parallel or opposed, has been provided.
3. Verify that damper frame attachment is properly secured and sealed.
4. Verify that damper actuator and linkage attachment are secure.
5. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
6. Verify that damper blade travel is unobstructed.

F. Control Valve Checkout:
1. Verify that control valves are installed correctly for flow direction.
2. Verify that valve body attachment is properly secured and sealed.
3. Verify that valve actuator and linkage attachment are secure.
4. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
5. Verify that valve ball, disc, or plug travel is unobstructed.
6. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace valve if leaks persist.

G. Instrument Checkout:

1. Verify that instrument is correctly installed for location, orientation, direction, and operating clearances.
2. Verify that attachment is properly secured and sealed.
3. Verify that conduit connections are properly secured and sealed.
4. Verify that wiring is properly labeled with unique identification, correct type, and size and is securely attached to proper terminals.
5. Inspect instrument tag against approved submittal.
6. For instruments with tubing connections, verify that tubing attachment is secure and isolation valves have been provided.
7. For flow instruments, verify that recommended upstream and downstream distances have been maintained.
8. For temperature instruments, verify the following:

a. Sensing element type and proper material.
b. Length and insertion.

3.19 DDC SYSTEM I/O ADJUSTMENT, CALIBRATION, AND TESTING

A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.

B. Provide written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.

C. For each analog instrument, make three-point test of calibration for both linearity and accuracy.

D. Equipment and procedures used for calibration to comply with instrument manufacturer's written instructions.

E. Provide diagnostic and test equipment for calibration and adjustment.

1. Use field testing and diagnostic instruments and equipment with an accuracy at least twice the instrument accuracy of instrument to be calibrated. For example, test and

calibrate an installed instrument with accuracy of 1 percent using field testing and diagnostic instrument with accuracy of 0.5 percent or better.

F. Calibrate each instrument in accordance with instruction manual supplied by instrument manufacturer.

G. If after calibration the indicated performance cannot be achieved, replace out-of-tolerance instruments.

H. Comply with field testing requirements and procedures indicated by ASHRAE's Guideline 11, "Field Testing of HVAC Controls Components," in the absence of specific requirements, and to supplement requirements indicated.

I. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

J. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact making or breaking.

K. Control Dampers:

1. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
2. Check and document open and close cycle times for applications with cycle time less than 30 seconds.
3. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

L. Control Valves:

1. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
2. Check and document open and close cycle times for applications with cycle time less than 30 seconds.

M. Meters: Check meters at zero, 50, and 100 percent of Project design values.

N. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

O. Switches: Calibrate switches to make or break contact at set points indicated.

P. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistant source.

3.20 DDC SYSTEM CONTROLLER CHECKOUT

A. Verify power supply.

1. Verify voltage, phase, and hertz.
2. Verify that protection from power surges is installed and functioning.
3. Verify that ground fault protection is installed.
4. If applicable, verify if connected to UPS unit.
5. If applicable, verify if connected to backup power source.
6. If applicable, verify that power conditioning units are installed.

B. Verify that wire and cabling are properly secured to terminals and labeled with unique identification.

C. Verify that spare I/O capacity is provided.

3.21 DDC CONTROLLER I/O CONTROL LOOP TESTS

A. Testing:

1. Test every I/O point connected to DDC controller to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.
2. Test every I/O point throughout its full operating range.
3. Test every control loop to verify that operation is stable and accurate.
4. Adjust control loop proportional, integral, and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
5. Test and adjust every control loop for proper operation according to sequence of operation.
6. Test software and hardware interlocks for proper operation. Correct deficiencies.
7. Operate each analog point at the following:

    a. Upper quarter of range.
    b. Lower quarter of range.
    c. At midpoint of range.

8. Exercise each binary point.
9. For every I/O point in DDC system, read and record each value at operator workstation, at DDC controller, and at field instrument simultaneously. Value displayed at operator workstation, at DDC controller, and at field instrument must match.
10. Prepare and submit report documenting results for each I/O point in DDC system and include in each I/O point a description of corrective measures and adjustments made to achieve desire results.

3.22 DDC SYSTEM VALIDATION TESTS

A. Perform validation tests before requesting final review of system. Before beginning testing, first submit Pretest Checklist and Test Plan.

B. After review of Pretest Checklist and Test Plan, execute all tests and procedures indicated in plan.

C. After testing is complete, submit completed Pretest Checklist.

D. Pretest Checklist: Submit the following list with items checked off once verified:

1. Detailed explanation for any items that are not completed or verified.
2. Required mechanical installation work is successfully completed and HVAC equipment is working correctly.
3. HVAC equipment motors operate below full-load amperage ratings.
4. Required DDC system components, wiring, and accessories are installed.
5. Installed DDC system architecture matches approved Drawings.
6. Control electric power circuits operate at proper voltage and are free from faults.
7. Required surge protection is installed.
8. DDC system network communications function properly, including uploading and downloading programming changes.
9. Using BACnet protocol analyzer, verify that communications are error free.
10. Each controller's programming is backed up.
11. Equipment, products, tubing, wiring cable, and conduits are properly labeled.
12. All I/O points are programmed into controllers.
13. Testing, adjusting, and balancing work affecting controls is complete.
14. Dampers and actuators zero and span adjustments are set properly.
15. Each control damper and actuator goes to failed position on loss of power and loss of signal.
16. Valves and actuators zero and span adjustments are set properly.
17. Each control valve and actuator goes to failed position on loss of power and loss of signal.
18. Meter, sensor, and transmitter readings are accurate and calibrated.
19. Control loops are tuned for smooth and stable operation.
20. View trend data where applicable.
21. Each controller works properly in standalone mode.
22. Safety controls and devices function properly.
23. Interfaces with fire-alarm system function properly.
24. Electrical interlocks function properly.
25. Operator workstations and other interfaces are delivered, all system and database software is installed, and graphics are created.
26. Record Drawings are completed.

E. Test Plan:

1. Prepare and submit validation Test Plan including test procedures for performance validation tests.
2. Address all specified functions of DDC system and sequences of operation in Test Plan.
3. Explain detailed actions and expected results to demonstrate compliance with requirements indicated.
4. Explain method for simulating necessary conditions of operation used to demonstrate performance.
5. Include Test Checklist to be used to check and initial that each test has been successfully completed.
6. Submit Test Plan documentation 10 business days before start of tests.

F. Validation Test:

1. Verify operating performance of each I/O point in DDC system.

    a. Verify analog I/O points at operating value.

b. Make adjustments to out-of-tolerance I/O points.

1) Identify I/O points for future reference.
2) Simulate abnormal conditions to demonstrate proper function of safety devices.
3) Replace instruments and controllers that cannot maintain performance indicated after adjustments.

2. Simulate conditions to demonstrate proper sequence of control.
3. Readjust settings to design values and observe ability of DDC system to establish desired conditions.
4. 24 hours after initial validation test, do as follows:

a. Re-check I/O points that required corrections during initial test.
b. Identify I/O points that still require additional correction and make corrections necessary to achieve desired results.

5. 24 Hours after second validation test, do as follows:

a. Re-check I/O points that required corrections during second test.
b. Continue validation testing until I/O point is normal on two consecutive tests.

6. Completely check out, calibrate, and test all connected hardware and software to ensure that DDC system performs according to requirements indicated.
7. After validation testing is complete, prepare and submit report indicating results of testing. For all I/O points that required correction, indicate how many validation re-tests it took to pass. Identify adjustments made for each test and indicate instruments that were replaced.

G. DDC System Response Time Test:

1. Simulate HLC.

a. Heavy load to be occurrence of 50 percent of total connected binary COV, one-half of which represents "alarm" condition, and 50 percent of total connected analog COV, one-half of which represents "alarm" condition, that are initiated simultaneously on a one-time basis.

2. Initiate 10 successive occurrences of HLC and measure response time to typical alarms and status changes.
3. Measure with timer having at least 0.1-second resolution and 0.01 percent accuracy.
4. Purpose of test is to demonstrate DDC system, as follows:

a. Reaction to COV and alarm conditions during HLC.
b. Ability to update DDC system database during HLC.

5. Passing test is contingent on the following:

a. Alarm reporting at printer beginning no more than two seconds after initiation (time zero) of HLC.
b. All alarms, both binary and analog, are reported and printed; none are lost.
c. Compliance with response times specified.

6. Prepare and submit report documenting HLC tested and results of test including time stamp and print out of all alarms.

H. DDC System Network Bandwidth Test:

1. Test network bandwidth usage on all DDC system networks to demonstrate bandwidth usage under DDC system normal operating conditions and under simulated HLC.
2. To pass, none of DDC system networks are to use more than 70 percent of available bandwidth under normal and HLC operation.

3.23 FINAL REVIEW

A. Submit written request to Architect Owner Commissioning Agent and Construction Manager when DDC system is ready for final review. State the following:

1. DDC system has been thoroughly inspected for compliance with Contract Documents and found to be in full compliance.
2. DDC system has been calibrated, adjusted, and tested and found to comply with requirements of operational stability, accuracy, speed, and other performance requirements indicated.
3. DDC system monitoring and control of HVAC systems results in operation according to sequences of operation indicated.
4. DDC system is complete and ready for final review.

B. Upon receipt of written request for final review, Architect, Owner, Commissioning Agent and Construction Manager to start review within reasonable period and upon completion issue field report(s) documenting observations and deficiencies.

C. Take prompt action to remedy deficiencies indicated in reviewer's field report(s) and submit second written request after all deficiencies have been corrected. Repeat process until no deficiencies are reported.

D. Compensation for Subsequent Reviews: Should more than two reviews be required, DDC system manufacturer and Installer to compensate entity/entities performing reviews for total costs (labor and expenses) associated with subsequent reviews. Estimated cost of each subsequent review to be submitted and approved by DDC system manufacturer and Installer before review.

E. Prepare and submit closeout submittals and begin procedures indicated in "Extended Operation Test" Article when no deficiencies are reported.

F. Part of DDC system final review shall to include demonstration to parties participating in final review.

1. Provide staff familiar with DDC system installed to demonstrate operation of DDC system during final review.
2. Provide testing equipment to demonstrate accuracy and other performance requirements of DDC system that is requested by reviewers during final review.
3. Demonstration to include, but not be limited to, the following:

a. Accuracy and calibration of 10 I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying performance requirements indicated, additional I/O points may be selected by

reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.

b. HVAC equipment and system hardwired and software safeties and life-safety functions are operating according to sequence of operation. Up to 10 I/O points to be randomly selected by reviewers. Additional I/O points may be selected by reviewers to discover problems with operation.
c. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored for randomly selected HVAC systems.
d. Operation of randomly selected dampers and valves in normal-on, normal-off, and failed positions.
e. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and operator workstations.
f. Trends, summaries, logs, and reports set up for Project.
g. For up to three HVAC systems randomly selected by reviewers, use graph trends to show that sequence of operation is executed in correct manner and that HVAC systems operate properly through complete sequence of operation including different modes of operations indicated. Show that control loops are stable and operating at set points and respond to changes in set point of 20 percent or more.
h. Software's ability to communicate with controllers, operator workstations, and uploading and downloading of control programs.
i. Software's ability to edit control programs offline.
j. Data entry to show Project-specific customizing capability including parameter changes.
k. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
l. Execution of digital and analog commands in graphic mode.
m. Spreadsheet and curve plot software and its integration with database.
n. Online user guide and help functions.
o. Multitasking by showing different operations occurring simultaneously on four quadrants of split screen.
p. System speed of response compared to requirements indicated.
q. For Each Network and Programmable Application Controller:

    1) Memory: Programmed data, parameters, trend, and alarm history collected during normal operation are not to be lost during power failure.
    2) Operator Interface: Ability to connect directly to each type of digital controller with portable workstation and mobile device. Show that maintenance personnel interface tools perform as indicated in manufacturer's technical literature.
    3) Standalone Ability: Demonstrate that controllers provide stable and reliable standalone operation using default values or other method for values normally read over network.
    4) Electric Power: Ability to disconnect any controller safely from its power source.
    5) Wiring Labels: Match control drawings.
    6) Network Communication: Ability to locate controller's location on network and communication architecture matches Shop Drawings.
    7) Nameplates and Tags: Accurate and permanently attached to control panel doors, instrument, actuators, and devices.

r. For Each Operator Workstation:

    1) I/O points lists agree with naming conventions.
    2) Graphics are complete.

3) UPS unit, if applicable, operates.

s. Communications and Interoperability: Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. Use ASHRAE 135 protocol analyzer to help identify devices, view network traffic, and verify interoperability. Requirements must be met even if only one manufacturer's equipment is installed.

1) Data Presentation: On each operator workstation, demonstrate graphic display capabilities.
2) Reading of Any Property: Demonstrate ability to read and display any used readable object property of any device on network.
3) Set-Point and Parameter Modifications: Show ability to modify set points and tuning parameters indicated. Modifications are made with messages and write services initiated by operator using workstation graphics, or by completing a field in menu with instructional text.
4) Peer-to-Peer Data Exchange: Network devices are installed and configured to perform without need for operator intervention to implement Project sequence of operation and to share global data.
5) Alarm and Event Management: Alarms and events are installed and prioritized according to Owner. Demonstrate that time delays and other logic are set up to avoid nuisance tripping. Show that operators with sufficient privileges are permitted.
6) Schedule Lists: Schedules are configured for start and stop, mode change, occupant overrides, and night setback as defined in sequence of operations.
7) Schedule Display and Modification: Ability to display any schedule with start and stop times for calendar year. Show that all calendar entries and schedules are modifiable from any connected operator workstation by an operator with sufficient privilege.
8) Archival Storage of Data: Data archiving is handled by operator workstation and server and local trend archiving and display is accomplished.
9) Modification of Trend Log Object Parameters: Operator with sufficient privilege can change logged data points, sampling rate, and trend duration.
10) Device and Network Management:

a) Display of network device status.
b) Display of BACnet object information.
c) Silencing devices transmitting erroneous data.
d) Time synchronization.
e) Remote device re-initialization.
f) Backup and restore network device programming and master database(s).
g) Configuration management of routers.

3.24 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.25 MAINTENANCE SERVICE

A. Beginning at Substantial Completion, verify that maintenance service includes 12 months' full maintenance by DDC system manufacturer's authorized service representative. Include monthly preventive maintenance, repair or replacement of worn or defective components, cleaning, calibration, and adjusting as required for proper operation. Use only manufacturer's authorized replacement parts and supplies.

3.26 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, verify that service agreement includes software support for two year(s).

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two year(s) from date of Substantial Completion. Verify that upgrading software includes operating system and new or revised licenses for using software.

1. Upgrade Notice: No fewer than 30 days to allow Owner to schedule and access system and to upgrade computer equipment if necessary.

3.27 DEMONSTRATION

A. Engage a factory-authorized service representative with complete knowledge of Project-specific system installed to train Owner's maintenance personnel to adjust, operate, and maintain DDC system.

B. Extent of Training:

1. Base extent of training on scope and complexity of DDC system indicated and training requirements indicated. Provide extent of training required to satisfy requirements indicated even if more than minimum training requirements are indicated.
2. Inform Owner of anticipated training requirements if more than minimum training requirements are indicated.
3. Minimum Training Requirements:

    a. Provide not less than five days of training total.
    b. Stagger training over multiple training classes to accommodate Owner's requirements. All training to occur before end of warranty period.
    c. Break down total days of training into not more than two separate training classes.
    d. Schedule training so each training class is not less than one consecutive day(s).

C. Training Schedule:

1. Schedule training with Owner 20 business days before expected Substantial Completion.
2. Schedule training to provide Owner with at least 10 business days of notice in advance of training.
3. Training to occur within normal business hours at mutually agreed on time. Unless otherwise agreed to, training to occur Monday through Friday, except on U.S. Federal holidays, with two morning sessions and two afternoon sessions. Each morning session and afternoon session to be split in half with 15-minute break between sessions. Morning

and afternoon sessions to be separated by 30-minute lunch period. Training, including breaks and excluding lunch period, are not to exceed eight hours per day.

4. Provide staggered training schedule as requested by Owner.

D. Training Attendee List and Sign-in Sheet:

1. Request from Owner in advance of training a proposed attendee list with name, phone number, and email address.
2. Provide preprinted sign-in sheet for each training session with proposed attendees listed and no fewer than six blank spaces to add additional attendees.
3. Include preprinted sign-in sheet with training session number, date and time, instructor name, phone number, email address, and brief description of content to be covered during session. List attendees with columns for name, phone number, and email address and a column for attendee signature or initials.
4. Circulate sign-in sheet at beginning of each session and solicit attendees to sign or initial in applicable location.
5. At end of each training day, send Owner an email with attachment of scanned copy (PDF) of circulated sign-in sheet for each session. Indicate which attendees, if any, joined for only part of training sessions.

E. Attendee Training Manuals:

1. Provide each attendee with color hard copy of all training materials and visual presentations.
2. Organize hard-copy materials in three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes DVD or flash drive with PDF copy of all hard-copy materials.

F. Instructor Requirements:

1. One or multiple qualified instructors, as required, to provide training.
2. Use instructors who have provided not less than five years of instructional training on not less than five past projects with similar DDC system scope and complexity to DDC system installed.

G. Organization of Training Sessions:

1. Organize training sessions into logical groupings of technical content and to reflect different levels of operators having access to system. Plan training sessions to accommodate the following three levels of operators:

    a. Daily operators.
    b. Advanced operators.
    c. System managers and administrators.

2. Plan and organize training sessions to group training content to protect DDC system security. Some attendees may be restricted to some training sessions to ensure DDC system security.

H. Training Outline:

1. Submit training outline for Owner review at least 10 business day before scheduling training.
2. Include in outline a detailed agenda for each training day that is broken down into each of four training sessions that day, training objectives for each training session, and synopses for each lesson planned.

I. On-Site Training:

1. Owner will provide conditioned classroom or workspace with ample desks or tables, chairs, power, and data connectivity for instructor and each attendee.
2. Provide training materials, projector, and other audiovisual equipment used in training.
3. Provide as much of training located on-site as deemed feasible and practical by Owner.
4. Include on-site training with regular walk-through tours, as required, to observe each unique product type installed with hands-on review of operation, calibration, and service requirements.
5. Use operator workstation that is to be used with DDC system in the training. If operator workstations are unavailable, provide temporary workstation to convey training content.

J. Off-Site Training:

1. Provide conditioned training rooms and workspace with ample tables desks or tables, chairs, power, and data connectivity for each attendee.
2. Provide capability to remotely access to Project DDC system for use in training.
3. Provide operator workstation for use by each attendee.

K. Training Content for Daily Operators:

1. Basic operation of system.
2. Understanding DDC system architecture and configuration.
3. Understanding each unique product type installed including performance and service requirements for each.
4. Understanding operation of each system and equipment controlled by DDC system including sequences of operation, each unique control algorithm, and each unique optimization routine.
5. Operating operator workstations, printers, and other peripherals.
6. Logging on and off system.
7. Accessing graphics, reports, and alarms.
8. Adjusting and changing set points and time schedules.
9. Recognizing DDC system malfunctions.
10. Understanding content of operation and maintenance manuals including control drawings.
11. Understanding physical location and placement of DDC controllers and I/O hardware.
12. Accessing data from DDC controllers.
13. Operating portable operator workstations.
14. Review of DDC testing results to establish basic understanding of DDC system operating performance and HVAC system limitations as of Substantial Completion.
15. Running each specified report and log.
16. Displaying and demonstrating each data entry to show Project-specific customizing capability. Demonstrating parameter changes.
17. Stepping through graphics penetration tree, displaying all graphics, demonstrating dynamic updating, and direct access to graphics.
18. Executing digital and analog commands in graphic mode.
19. Demonstrating control loop precision and stability via trend logs of I/O for not less than 10 percent of I/O installed.

20. Demonstrating DDC system performance through trend logs and command tracing.
21. Demonstrating scan, update, and alarm responsiveness.
22. Demonstrating spreadsheet and curve plot software, and its integration with database.
23. Demonstrating on-line user guide, and help function and mail facility.
24. Demonstrating multitasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.
25. Demonstrating the following for HVAC systems and equipment controlled by DDC system:

    a. Operation of HVAC equipment in normal-off, normal-on, and failed conditions while observing individual equipment, dampers, and valves for correct position under each condition.
    b. For HVAC equipment with factory-installed software, show that integration into DDC system is able to communicate with DDC controllers or gateways, as applicable.
    c. Using graphed trends, show that sequence of operation is executed in correct manner, and HVAC systems operate properly through complete sequence of operation including seasonal change, occupied and unoccupied modes, warm-up and cool-down cycles, and other modes of operation indicated.
    d. Hardware interlocks and safeties function properly and DDC system performs correct sequence of operation after electrical power interruption and resumption after power is restored.
    e. Reporting of alarm conditions for each alarm, and confirm that alarms are received at assigned locations, including operator workstations.
    f. Each control loop responds to set-point adjustment and stabilizes within time period indicated.
    g. Sharing of previously graphed trends of all control loops to demonstrate that each control loop is stable and set points are being maintained.

L. Training Content for Advanced Operators:

1. Making and changing workstation graphics.
2. Creating, deleting, and modifying alarms including annunciation and routing.
3. Creating, deleting, and modifying point trend logs including graphing and printing on an ad-hoc basis and operator-defined time intervals.
4. Creating, deleting, and modifying reports.
5. Creating, deleting, and modifying points.
6. Creating, deleting, and modifying programming including ability to edit control programs offline.
7. Creating, deleting, and modifying system graphics and other types of displays.
8. Adding DDC controllers and other network communication devices such as gateways and routers.
9. Adding operator workstations.
10. Performing DDC system checkout and diagnostic procedures.
11. Performing DDC controller operation and maintenance procedures.
12. Performing operator workstation operation and maintenance procedures.
13. Configuring DDC system hardware including controllers, workstations, communication devices, and I/O points.
14. Maintaining, calibrating, troubleshooting, diagnosing, and repairing hardware.
15. Adjusting, calibrating, and replacing DDC system components.

M. Training Content for System Managers and Administrators:

1. DDC system software maintenance and backups.

2. Uploading, downloading, and offline archiving of all DDC system software and databases.
3. Interface with Project-specific, third-party operator software.
4. Understanding password and security procedures.
5. Adding new operators and making modifications to existing operators.
6. Operator password assignments and modification.
7. Operator authority assignment and modification.
8. Workstation data segregation and modification.

N. Video of Training Sessions:

1. Provide digital video and audio recording of each training session. Create separate recording file for each session.
2. Stamp each recording file with training session number, session name, and date.
3. Provide Owner with two copies of digital files on cloud and flash drives for later reference and for use in future training.
4. Owner retains right to make additional copies for intended training purposes without having to pay royalties.

END OF SECTION 230900

SECTION 232113 – HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Condensate-drain piping.
2. Dielectric fittings.
3. Backflow preventer.
4. Y-pattern strainers.
5. Air-vent piping.
6. Safety-valve-inlet and -outlet piping.

1.3 DEFINITIONS

A. PTFE: Polytetrafluoroethylene.

B. RTRF: Reinforced thermosetting resin (fiberglass) fittings.

C. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.4 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

1. Hot-Water Heating Piping: 125 psig at 200 deg F.
2. Chilled-Water Piping: 125 psig at 200 deg F.
3. Makeup-Water Piping: 80 psig at 150 deg F.
4. Condensate-Drain Piping: 150 deg F.
5. Air-Vent Piping: 200 deg F.

1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Plastic pipe and fittings with solvent cement.
2. Pressure-seal fittings.

3. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
4. Air control devices.
5. Chemical treatment.
6. Hydronic specialties.

A. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

B. Grooved joint couplings and fittings shall be referred to on drawings and product submittals, and be identified by the manufacturer’s listed model or series designation.

C. Welding certificates.

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For air control devices, hydronic specialties, and special- duty valves to include in emergency, operation, and maintenance manuals.

G. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

E. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.

1. Grooved-End Copper Fittings: ASME B16.22 wrought copper and ASTM B 75, copper tube or ASME B16.18 and ASTM B 584, bronze casting. Manufactured to copper tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.) Basis of Design: Victaulic Copper Connection.
2. Grooved-End-Tube Couplings: Rigid pattern with offsetting angle-pattern bolt pads, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching copper-tube and fitting grooves, EPDM-HP center-leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth, rated for minimum 230 deg F for use with housing, and ASTM A449 compliant steel bolts and nuts. Installation- Ready, for direct stab installation without field disassembly. Basis of Design: Victaulic Style 607.
3. Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.

E. Wrought-Copper Unions: ASME B16.22.

F. Copper or Bronze Pressure-Seal Fittings:

1. Manufacturers: All boiler venting shall be furnished by the boiler manufacturer. Subject to compliance with requirements, provide products by one of the following:

   a. Mueller Industries, Inc
   b. Nibco Inc.
   c. Viega LLC

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.

2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Grooved Joint Lubricants: If required, lubricate gasket in accordance with the manufacturer's published instructions with lubricant approved for the gasket elastomer and fluid media. Basis of Design: Victaulic Vic-Lube.

G. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.3 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Pipeline Seal and Insulator, Inc.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

C. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Victaulic Company of America.

2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

3. Copper-silicon casting conforming to UNS C87850 with grooved and/or threaded ends. UL classified in accordance with ANSI / NSF-61 for potable water service. Basis of Design: Victaulic Style 647.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered or pressure-seal joints for all indoor piping.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

T. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

U. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

V. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.

5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
7. NPS 4: Maximum span, 10 feet; minimum rod size, 1/2 inch.
8. NPS 6: Maximum span, 10 feet; minimum rod size, 1/2 inch.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

E. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings unless flexibility is required. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved coupling manufacturer’s factory trained field representative shall provide on-site training for contractor’s field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.

I. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

D. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-32:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Hot-Gas and Liquid Lines: 535 psig.

1.1 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:

1. Thermostatic expansion valves.
2. Solenoid valves.
3. Filter dryers.
4. Strainers.
5. Pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Shop Drawing Scale: 1/4 inch equals 1 foot.
2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Welding certificates.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.7 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type L.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

D. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.
8. Manual operator.

E. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig.
6. Maximum Operating Temperature: 240 deg F.

F. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F.
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 700 psig.

G. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

H. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

I. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

J. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

2.3 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

C. ASHRAE 34, R-32: Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-32

A. Suction Lines NPS 3-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

C. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

D. Install a full-sized, three-valve bypass around filter dryers.

E. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

F. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

G. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

I. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Compressor.

J. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

K. Install receivers sized to accommodate pump-down charge.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Install refrigerant piping in protective conduit where installed belowground.

L. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

M. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

N. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113 – METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Perimeter moldings.

D. Welding certificates.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lindab Inc.
    b. McGill AirFlow LLC.
    c. SEMCO Incorporated.
    d. Sheet Metal Connectors, Inc.
    e. Spiral Manufacturing Co., Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.
e. Maximum Thermal Conductivity:

1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

a. Fan discharges.
b. Intervals of lined duct preceding unlined duct.

8. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.

9. Conditioned Space, Supply-Air Ducts in Pressure Classes2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.1 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections[, selected by Architect from sections installed,] totaling no less than 25 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.2 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.3 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.4 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. Ducts Connected to Constant-Volume Air-Handling Units:

    a. Pressure Class: Positive 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 6.
    d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 3.
    d. SMACNA Leakage Class for Round and Flat Oval: 3.

C. Return Ducts:

1. Ducts Connected to Air-Handling Units:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 6.
    d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 3.
    d. SMACNA Leakage Class for Round and Flat Oval: 3.

D. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

E. Liner Schedule:

1. Supply Air Ducts: Fibrous glass, Type I, 1 inch thick.
2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.
3. Supply Fan Plenums: Fibrous glass, Type II, 1 inch thick.
4. Provide acoustical lining 15 ft. upstream and downstream of all air handling equipment on supply and return ductwork, whether indicated on the drawings or not. Air handling equipment includes, but is not limited to, air handling units, roof top units. If a branch takeoff occurs in the 15 ft., line entire takeoff. Provide acoustical lining for all outside air plenums, return air plenums and transfer ducts.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

    a. Velocity 1000 fpm or Lower:

        1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
        2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233116 – PRE-MANUFACTURED EXTERIOR DUCTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Phenolic-foam ducts and fittings.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for nonmetal ducts.
2. Section 233113 "Metal Ducts" for single- and double-wall, rectangular and round ducts.
3. Section 233300 "Air Duct Accessories" for dampers, duct-mounting access doors and panels, turning vanes, and flexible ducts.
4. Division 05 Section “Cold Form Steel Framing” specification for coordination of mounting vertical exterior mounted ductwork.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including duct closure, reinforcements, and hangers and supports, shall comply with SMACNA's "Fibrous Glass Duct Construction Standards" and performance requirements and design criteria indicated.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "Phenolic Duct Construction Standards."

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Phenolic-foam duct materials.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2.

3. Duct layout indicating sizes and pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Perimeter moldings.

D. Welding certificates.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 PHENOLIC-FOAM DUCTS AND FITTINGS

A. Manufacturers:

1. Dual-Tech system, by PTM Manufacturing, LLC. Newark, DE, 19713 302-455-9733.
2. Thermaduct LLC.
3. AQC QDuct
4. Engineer approved equal.

B. Duct Panel: CFC/HCFC-free phenolic-foam autohesively bonded on both sides to a 1 mil low vapor permeability aluminum foil facing reinforced with a 0.2” glass scrim.

1. Duct work shall be double wall R-16.
2. Insulation panels shall comprise a 3.4-3.75 nominal density.
3. Maximum Temperature: 158 deg F inside ducts or ambient temperature surrounding ducts.
4. Maximum Thermal Conductivity: 0.13 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
5. Minimum compressive strength: 29 psi.
6. Permeability: 0.0002 perms maximum when tested according to ASTM E 96/E 96M, Procedure A.
7. Antimicrobial Agent: Compound shall be tested for efficacy by an NRTL, and registered by the EPA for use in HVAC systems.
8. Noise-Reduction Coefficient: 0.65 minimum when tested according to ASTM C 423, Mounting A.
9. Foil tape used for sealing the insulation edges shall be a minimum thickness of 1.25 mils.
10. Required Markings: UL label and other markings required by UL 181 on each full sheet of duct panel; UL ratings for closure materials.
11. The rigid phenolic insulation panels used in the fabrication of the exterior ductwork and/or ductwork sections fabricated from the manufacturers system shall achieve the following fire and smoke performance requirements:

    a. ASTM E 84-08a – unfaced or composite (insulation, facing and adhesive) of low contribution to fire growth not exceeding 25 flame spread and 50 smoke developed indices.
    b. UL 723 – unfaced or composite (insulation, facing and adhesive) of low contribution to fire growth not exceeding 25 flame spread and 50 smoke developed indices.
    c. UL 181 – UL/ULC classification as a Class 1 air duct to NFPA Standards 90A & 90B.

C. Closure Materials:

1. V-Groove Adhesive: Silicone.

    a. As approved by or supplied by manufacturer of exterior ducting.
    b. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    c. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile

Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2. Pressure-Sensitive Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-P," the manufacturer's name, and a date code.

   a. As approved by or supplied by manufacturer of exterior ducting
   b. Tape: Aluminum foil tape imprinted with listing information.
   c. Minimum Tape Width: 3 inches.
   d. Water resistant.
   e. Mold and mildew resistant.

D. Fabrication:

1. Sizing: Panel system shall be sized in four overlapping sections to provide a complete seal surrounding ducting.
2. Shall be laminated to the weather barrier and sized to allow for sufficient overlap. Second wall ducting shall be adhered utilizing appropriate contact method.
3. Where feasible all general fabrication shall be performed in the shop and be based off of approved project drawing or direct field measurements.
4. Field fabrication should be limited to routing and sealing of the ducting sections to allow for duct angle, supports, gauges or other duct related necessities. All routed areas shall be resealed with appropriate foil faced cast tape. No insulation/phenolic material shall be exposed to the environment.
5. Fabricate 90-degree mitered elbows to include turning vanes.

2.2 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
2. Strap and Rod Sizes: Comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible” for steel sheet width and thickness and for steel rod diameters.
3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

C. Penetration into duct is not permitted.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
3. Supports for Aluminum Ducts: Aluminum support materials unless materials are

electrolytically separated from dcuts.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts with fewest possible joints.

C. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

D. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

E. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

F. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges. Overlap openings on four sides by at least 1-1/2 inches.

G. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

H. Protect duct interiors from the moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

I. Install foam ducts and fittings to comply with manufacturer’s guidelines.

J. Ducting system sections shall be fitted into place and connected using aluminium flange and gasket as designed by manufacturer.

K. Weather barrier shall be fabricated of mill finished embossed aluminum sheeting, 0.032” in thickness. Exposed seams to be covered with 1” butyl and a 8” embossed aluminum beaded bands, secured with #10 self-tapping, stainless screws with weather seal washers.

L. At weather barrier abutment locations, and industrial grade RTV silicone caulk shall be utilized, where applicable.

M. Seams exposed to the weather shall be covered and sealed with a 1” wide by 1/8” thick butyl compound.

N. All screws utilized to fasten panel system together shall be #10 x ½” self-tapping, stainless steel, weather seal washer screws.

O. Contact cement or 2-sided adhesive tape shall be utilized for laminating insulation material to the weather barrier sheeting.

3.2 HANGER AND SUPPORT INSTALLATION

A. Install hangers and supports for phenolic-foam ducts and fittings to comply with manufacturer's guidelines.

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "Phenolic Duct Construction Standards" for branch, outlet and inlet, and terminal unit connections.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of nonmetal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch duct as recommended by duct manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

2. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of ducts or duct accessories.
3. Clean fibrous-glass duct with HEPA vacuuming equipment; do not permit duct to get wet. Replace fibrous-glass duct that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
4. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
5. Provide drainage and cleanup for wash-down procedures.
6. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.6 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.7 DUCT SCHEDULE

A. Outdoor Ducts and Fittings:

1. Phenolic-Foam Rectangular Ducts and Fittings:

a. Minimum Panel Thickness: 1-3/32 inches.
b. Aluminum Cladding: Minimum 0.032 inch thick.
c. Polymeric Sealing System: Coat ducts, including gang-nail couplings, grip flanges, and couplings.

END OF SECTION 233116

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Combination fire and smoke dampers
4. Flange connectors.
5. Turning vanes.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Flexible ducts.
9. Duct accessory hardware.

B. Related Sections:

1. Division 23 Section "HVAC Power Ventilators" for roof-mounted exhaust fans.

1.3 SUBMITTALS

A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control damper installations.
d. Wiring Diagrams: For power, signal, and control wiring.

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

C. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.1 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Potorff.
3. Ruskin Company.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 1-inch wg.

E. Frame: 0.052-inch thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Neoprene, mechanically locked.

I. Blade Axles:

1. Material: Nonferrous metal.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.
    a. Sleeve Thickness: 20-gage minimum.
    b. Sleeve Length: 6 inches minimum.
6. Screen Material: Galvanized steel.
7. Screen Type: Insect.
8. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

A. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Greenheck Fan Corporation.
    b. Pottorff.
    c. Ruskin Company.
2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
3. Suitable for horizontal or vertical applications.
4. Frames:
    a. Hat shaped.
    b. Galvanized-steel channels, 0.064 inch thick.
    c. Mitered and welded corners.
    d. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized, roll-formed steel, 0.064 inch thick.

6. Blade Axles: Nonferrous metal.
7. Bearings:

a. Oil-impregnated bronze.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Blade Seals: Neoprene.
9. Jamb Seals: Cambered stainless steel.
10. Tie Bars and Brackets: Galvanized steel.
11. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

2.4 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Greenheck.
2. Potorff.
3. Ruskin.

B. General Requirements:

1. Label to indicate conformance to UL 555 and UL 555S by an NRTL.
2. Label to indicate conformance to NFPA 80 and NFPA 90A by an NRTL.
3. Unless otherwise indicated, use parallel-blade configuration.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000 fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Performance:

1. AMCA Certification: Test and rate in accordance with AMCE Publication 511.
2. Leakage:

a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. (15.2 L/s per sq. m) against 1-inch wg (250-Pa) differential static pressure.
b. Class I: Leakage shall not exceed 4 cfm/sq. ft. (20 L/s/ per sq. m) against 1-inch wg (250-Pa) differential static pressure.
c. Class II: Leakage shall not exceed 10 cfm/sq. ft. (51 L/s per sq. m) against 1-inch wg (250-Pa) differential static pressure.

3. Pressure Drop: 0.05 in. wg (12.5 Pa) at 1500 fpm (7.6 m/s) across a 24-by-24-inch (600-by-600-mm) damper when tested in accordance with AMCA 500-D, Figure 5.3.
4. Velocity: Up to 3000 fpm (15 m/s).

5. Temperature: Minus 25 to plus 180 deg F (Minus 32 to plus 83 deg C).
6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

F. Construction:

1. Suitable or horizontal or vertical airflow applications.
2. Linkage out of airstream.
3. Frame:

    a. Hat shaped.
    b. Galvanized sheet steel, with welded interlocking, gusseted corners and mounting flange.
    c. Gauge is to be in accordance with UL listing.

4. Blades:

    a. Roll-formed, horizontal, v-groove, galvanized sheet steel.
    b. Maximum width and gauge in accordance with UL listing.

5. Blade Edging Seals:

    a. Silicone rubber.

6. Blade Jamb Seal: Flexible stainless steel, compression type.
7. Blade Axles: 1/2-inch- (13-mm-) diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of airstream.
8. Bearings:

    a. Oil-impregnated bronze sleeve

G. Mounting Sleeve:

1. Factory installed, galvanized sheet steel.
2. Length to suit wall or floor application with factory-furnished silicone caulking.
3. Gauge in accordance with UL listing.

H. Heat-Responsive Device:

1. Resettable, 165 deg F (74 deg C) rated, fusible links
2. Electric resettable link and switch package, factory installed, rated.

I. Master control panel for use in dynamic smoke-management systems.

J. Damper Actuator - Electric:

1. Electric - 120 V ac.
2. UL 873, plenum rated.
3. Designed to operate in smoke-control systems complying with UL 555S requirements.
4. Two position with fail-safe spring return.

    a. Sufficient motor torque and spring torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.

b. Maximum 15-second full-stroke closure.
c. Minimum 90-degree drive rotation.

5. Clockwise or counterclockwise drive rotation as required for application.
6. Environmental Operating Range:

a. Temperature: Minus 40 to plus 130 deg F ((Minus 40 to plus 55 deg C)).
b. Humidity: 5 to 95 percent relative humidity noncondensing.

7. Environmental Enclosure: NEMA 2.
8. Actuator to be factory mounted and provided with single-point wiring connection.

K. Controllers, Electrical Devices, and Wiring:

1. Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
2. Electrical Connection: 115 V, single phase, 60 Hz

2.5 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. SEMCO Incorporated.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

E. Vane Construction: Double wall.

F. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.7 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Greenheck Fan Corporation.
3. McGill AirFlow LLC.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.8 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.

D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch wide, 0.028-inch thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.10 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2004.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire dampers in accordance with UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire dampers, to reset or reinstall fusible links. Access doors for access to fire dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream and downstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect supply diffusers to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

O. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Inspect turning vanes for proper and secure installation.
4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof-mounted centrifugal fans.
2. In-line centrifugal fans
3. Ceiling mounted fans

1.1 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Field quality-control reports.
E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. PennBarry.

B. Housing: Aluminum louvered penthouse and bird screen mounted to the discharge perimeter.

C. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
5. Motor Pulleys: Adjustable pitch for use with motors through 5 hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions. Provide fixed pitch for use with motors larger than 5 hp.

D. Fan Wheels: Aluminum, centrifugal backward inclined.

E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: 12 inches. Final height of the roof curb shall be coordinated with the total thickness of the roofing insulation at all locations on the roof, prior to the release of the equipment curbs.
3. With damper tray.

F. Accessories:

1. Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
2. Refer to scheduled accessories on contract drawings.

2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with performance requirements, provide products by one of the following:
1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. PennBarry.

B. Housing:
1. Square design constructed of galvanized steel and shall include square duct mounting collars.
2. Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.

C. Housing Supports and Drive Frame:

1. Housing supports are constructed of structural steel with formed flanges.
2. Drive frame is welded steel which supports the motor.

D. Fan Wheels:

1. Non-overloading, backward inclined centrifugal wheel.
2. Constructed of aluminum.
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.
5. Single thickness blades are securely riveted or welded to a heavy gauge back plate and wheel cone.

E. Electronically Commutated Motor

1. Motor enclosures: Open type
2. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications.
3. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
5. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by a potentiometer dial mounted at the motor.
6. Motor shall be a minimum of 85% efficient at all speeds.

F. Disconnect Switch:

1. NEMA Rated: 1
2. Positive electrical shut-off
3. Wired from fan motor to junction box

G. Duct Collars:

1. Square design to provide a large discharge area
2. Inlet and discharge collars provide easy duct connection

H. Access Panel:

1. Two sided access panels, permit easy access to all internal components
2. Located perpendicular to the motor mounting panel

I. Options/Accessories:

1. Damper:

a. Type: Gravity
b. Galvanized frames with prepunched mounting holes
c. Balanced for minimal resistance to flow

2. Insulated Housing, for noise reduction and condensation control

a. Thickness: 1 inches
b. Constructed of fiberglass liner

3. Isolation:

a. Type: Neoprene/Rubber Mount
b. Sized to match the weight of each fan

J. Controls:

1. Controls and control devices are specified in Section 230900 "Instrumentation and Control for HVAC" and on contract documents.

2.3 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with performance requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. PennBarry.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Refer to scheduled accessories on contract drawings.

2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.5 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

C. Secure roof curbs with cadmium-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

C. Replace fan and motor pulleys as required to achieve design airflow.

D. Lubricate bearings.

END OF SECTION 233423

SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Shutoff, single-duct air terminal units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of air terminal unit.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for air terminal units.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For air terminal units.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Size and location of initial access modules for acoustic tile.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Instructions for resetting minimum and maximum air volumes.
b. Instructions for adjusting software set points.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan-Powered-Unit Filters: Furnish one spare filter for each filter installed.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."

PART 2 - PRODUCTS

2.1 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Price
2. Titus
3. Warren Technology

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch thick galvanized steel, single wall.

1. Casing Liner: Comply with requirements in "Casing Liner" Article for rigid foil faced fiberglass duct liner.
2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.

4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
5. Fan: Forward-curved centrifugal.
6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Regulator Assembly: System-air-powered bellows section incorporating polypropylene bellows for volume regulation and thermostatic control. Bellows shall operate at temperatures from 0 to 140 deg F, shall be impervious to moisture and fungus, shall be suitable for 10-inch wg static pressure, and shall be factory tested for leaks.

E. Multi-point Airflow Sensor.

F. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally open.

G. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine- staked terminals secured with stainless-steel hardware.

1. Stage(s): Refer to plans.
2. Step controlled.
3. Access door interlocked disconnect switch.
4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable) by ATC.
5. Nickel chrome 80/20 heating elements.
6. Airflow switch for proof of airflow.
7. Fan interlock contacts.
8. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
9. Mercury contactors.
10. Magnetic contactor for each step of control (for three-phase coils).

H. Control devices:

1. Provide a 24V transformer

2. For other control devices refer to section 230900 “Instrumentation and Control for HVAC”.

2.2 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to ARI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Hangers and Supports" and with Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

A. Where installing piping adjacent to air terminal unit, allow space for service and maintenance.

B. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."

C. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

3.4 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.1 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Tests and Inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Perform the following tests and inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Air terminal unit will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.2 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Rectangular and square ceiling diffusers
2. Adjustable bar registers
3. Fixed face registers
4. Spiral duct grille

B. Related Sections:

1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

C. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Square Ceiling Diffusers (Tag-A):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Krueger.
   b. Price Industries.
   c. Titus.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel.
4. Finish: Baked enamel, white.
5. Face Size: 24 by 24 inches.
6. Face Style: Three cone.
7. Mounting: Surface.
8. Pattern: Fixed.
9. Dampers: Radial opposed blade, operable from diffuser face.
10. Accessories:

    a. Sectorizing baffles.

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Grille Tag-B:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Krueger.
   b. Price Industries.
   c. Titus.

2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Vertical spaced 3/4 inch apart.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Horizontal spaced 3/4 inch apart.
7. Frame: 1-1/4 inches wide.
8. Mounting: Countersunk screw.
9. Accessories:

   a. Rear-blade gang operator.

B. Fixed Face Bar Grille, Tag-C:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Price.
    b. Titus.
    c. Krueger.

2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.
5. Core Construction: Integral.
6. Frame: 1-1/4 inches wide.
7. Mounting: Countersunk screw.
8. Accessories:

    a. Opposed blade damper for all concealed gypsum board installations.

C. Spiral Duct Supply Register, Tag-D:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Price.
    b. Titus.
    c. Krueger.

2. Material: Steel.
3. Finish: Baked enamel, in color chosen by the architect.
4. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Vertical spaced 3/4 inch apart.
7. Frame: 1-1/4 inches wide.
8. Damper: Air scoop, operable from face.
9. Mounting: Countersunk screw.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 236200 - PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes packaged, refrigerant compressor and condenser units.

1.3 ACTION SUBMITTALS

A. Product Data: For each compressor and condenser unit. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include equipment dimensions, weights and structural loads, required clearances, method of field assembly, components, and location and size of each field connection.

B. Shop Drawings: For compressor and condenser units. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which compressor and condenser units will be attached.
2. Liquid and vapor pipe sizes.
3. Refrigerant specialties.
4. Piping including connections, oil traps, and double risers.
5. Compressors.
6. Evaporators.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For compressor and condenser units to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."

D. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

E. Unit shall be safety certified by ETL and be ETL US and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label.

F. Packaged air-cooled condenser units shall be certified in accordance with ANSI/ AHRI Standard 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment

1.7 COORDINATION

A. Coordinate location of piping and electrical rough-ins.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Compressor failure.
b. Condenser coil leak.

2. Warranty Period: Five years from date of Substantial Completion.
3. Warranty Period (Compressor Only): Five years from date of Substantial Completion.
4. Warranty Period (Components Other Than Compressor): Five years from date of Substantial Completion.
5. Warranty Period (Condenser Coil Only): Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMPRESSOR AND CONDENSER UNITS, AIR COOLED, 1 TO 5 TONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AAON.

2. Engineer approved equal.

B. Description: Condensing unit shall include compressors, air-cooled condenser coils, condenser fans, suction, liquid, and hot gas connection valves, and unit controls. Unit shall be factory assembled and tested including leak testing of the coil and run testing of the completed unit. Run test report shall be supplied with the unit. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components. Installation, Operation and Maintenance manual shall be supplied within the unit. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's access door.

C. Compressor:

1. Compressor shall be two-step scroll type with thermal overload protection independently circuited, and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. Two-step compressors shall include 2 stages of capacity control, 65% and 100% for 2 ton units only.
2. 3 Ton units and above shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity. Each compressor shall be furnished with a crankcase heater.
3. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
4. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, and service valves for liquid, suction, and hot gas connections. Liquid line filter driers shall be factory provided. Finished field installed refrigerant circuits shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line, insulated hot gas line and insulated suction line.
5. Unit shall include a factory holding charge of R-454B refrigerant and oil.
6. The compressor shall be covered by a high-density foam sound attenuating blanket to reduce radiated noise
7. Refrigeration circuit shall be provided with modulating hot gas reheat coil in the matching air handler, modulating valves, electronic controller, supply air temperature sensor and a dehumidification control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.
8. Refrigeration circuit shall be provided with external hot gas bypass to protect against evaporator frosting and to prevent excessive compressor cycling.

D. Motor:

1. Motor: ECM condenser fan motor shall be weather protected, single phase, and direct drive with inherent overload protection.
2. Accumulator: Suction tube.

E. Refrigerant: R-454B.

F. Condenser Coil:

1. Coils shall be designed for use with R-454B refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.

2. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
3. Coils shall be helium leak tested.

G. Condenser Fan: Condenser fan shall be vertical discharge, axial flow, direct drive fans.

H. Accessories:

1. Condensing unit shall be provided with on/off condenser fan cycling head pressure control and adjustable compressor lockout to allow cooling operation down to 35°F.
2. Unit shall be provided with standard power block for connecting power to the unit.
3. Control circuit transformer and wiring shall provide 24 VAC control voltage from the line voltage provided to the unit.

I. Unit Casing:

1. Unit shall be completely factory assembled, piped, and wired and shipped in one section.
2. Unit shall be specifically designed for outdoor application.
3. The condenser coil shall be mechanically protected from physical damage by painted galvanized steel louvers covering the full area of the coil.
4. Access to electrical and controls components shall be hinged access panel.
5. Exterior paint finish shall be capable of withstanding at least 1,000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.If Project has more than one type or configuration of compressor and condenser unit, delete paragraph below and schedule the units on Drawings.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate compressor and condenser units according to ARI 206/110.

B. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," Section 6, "Heating, Ventilating, and Air-Conditioning."

C. Test and inspect shell and tube condensers according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of compressor and condenser units.

B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where compressor and condenser units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated.

B. Maintain manufacturer's recommended clearances for service and maintenance.

C. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.3 CONNECTIONS

A. Comply with requirements for piping in other Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

C. Connect precharged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.

D. Connect refrigerant piping to air-cooled compressor and condenser units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Section 232300 "Refrigerant Piping."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized and factory-employed service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
2. Leak Test: After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Verify proper airflow over coils.

C. Compressor and condenser units will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized and factory-employed service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

a. Inspect for physical damage to unit casing.
b. Verify that access doors move freely and are weathertight.
c. Clean units and inspect for construction debris.
d. Verify that all bolts and screws are tight.
e. Adjust vibration isolation and flexible connections.
f. Verify that controls are connected and operational.

B. Lubricate bearings on fan motors.

C. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.

D. Adjust fan belts to proper alignment and tension.

E. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.

F. Measure and record airflow and air temperature rise over coils.

G. Verify proper operation of condenser capacity control device.

H. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

I. After startup and performance test, lubricate bearings.

3.6 DEMONSTRATION

A. Engage a factory-authorized and factory-employed service representative to train Owner's maintenance personnel to adjust, operate, and maintain compressor and condenser units.

END OF SECTION 236200

SECTION 237413 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged, outdoor, central-station air-handling units
   1. Rooftop Units
   2. Dedicated Outdoor Air Systems (DOAS Units).

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

B. ECM: Electrically commutated motor.

C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.4 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

A. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

B. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wind-Restraint Details: Detail fabrication and attachment of wind restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which RTUs will be attached.
2. Roof openings
3. Roof curbs and flashing.

B. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces of 115 MPH for Basic Wind Speed, Building Classification Category III and minimum 50 lb/sq. ft (48.8 kg/sq. m) multiplied by the maximum area of unit projected on a vertical plane that is normal to the wind direction and 45 degrees either side of normal for wind-restraint performance requirements.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control test reports.

D. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Two set of filters for each unit. (One set for installation at completion of project and one set for Owner's attic stock)

1.8 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 203/110 and ARI 303/110 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.
3. Packaged air-cooled condenser units shall be certified in accordance with ANSI/ AHRI Standard 340/360 performance rating of commercial and industrial unitary air- conditioning and heat pump equipment.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
4. Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

G. Unit shall be certified in accordance with ANSI Z21.47b/CSA 2.3b and ANSI Z83.8/CSA 2.6, Safety Standard Gas-Fired Furnaces.

H. Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard parts and associated labor, but not less than five years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard parts and associated labor, but not less than 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AAON
2. Valent
3. Daiken
4. LG

B. Note that Engineer will review in detail submittals for this equipment and will not approve incomplete submittals that do not clearly indicate or include in detail the items indicated to be provided in the above submittal section of this specification. Engineer will not approve submittals that do not meet or exceed all performance and construction requirements indicated in the specifications and drawings for this project. Any of the three manufacturers products noted above are to be provided by authorized manufacturer’s representative companies of the Contractor whom is submitting a proposal. Engineer will not approve submittals that do not come from the authorized manufacturer’s representative company for the Contractor whom is submitting a proposal. If authorized manufacturer’s representative company for the Contractor is different than authorized manufacturer’s representative company of the Engineer then authorized manufacturer’s representative company for the Contractor shall contact and coordinate with authorized manufacturer’s representative company of the Engineer. If contact and coordination are not performed Engineer will not approve submittals.

2.3 PACKAGED UNITS

A. General Description

1. Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, reheat coil, gas heaters, electric heaters, exhaust fans, energy recovery wheels, and unit controls.

2. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment’s literature pocket.

3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.

4. Unit components shall be labeled, including refrigeration system components and electri-

cal and controls components.

5. Estimated sound power levels (dB) shall be shown on the unit schedule.

6. Installation, Operation and Maintenance manual shall be supplied within the unit.

7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.

8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.

2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F.

3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.

4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.

6. Access to filters, dampers, cooling coils, reheat coil, heaters, exhaust fans, energy recovery wheels, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.

7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.

8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.

9. Unit shall be provided with base discharge and return air openings or horizontal discharge and return air opening (As indicated on contract drawings). All openings through

the unit shall have upturned flanges of at least 1/2 inch in height around the opening. All openings shall be in locations and orientation are shown on contract drawings. Manufactures that have different locations and orientation are responsible for all extra costs incurred as a result which will modify basis of design including but not limited to extra costs by contractor and Engineer for time to review the changes.

10. Unit shall include lifting lugs on the top of the unit.

11. Unit base pan shall be provided with 1/2 inch thick foam insulation.

12. Cabinet Surface Condensation:
    a. Cabinet shall have additional insulation and vapor seals if required to prevent condensation on the interior and exterior of the cabinet.
    b. Portions of cabinet located downstream from the cooling coil shall have a thermal break at each thermal bridge between the exterior and interior casing to prevent condensation from occurring on the interior and exterior surfaces. The thermal break shall not compromise the structural integrity of the cabinet.

C. Electrical

1. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.

2. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

3. Air-source heat pump where indicated on contract drawings shall include an optimized start defrost cycle to prevent frost accumulation on the outdoor coil during heat pump heating operation and to minimize defrost cycle energy usage. If the temperature of the outdoor heat exchanger and/or the suction line is less than a predetermined value, a deferred defrost cycle is initiated wherein the defrost cycle starts after a variable, continuously optimizing, time interval has elapsed. The defrost cycle is terminated when the relative temperatures of the outdoor heat exchanger and/or the suction line indicate that sufficient frost is melted from the heat exchanger to insure adequate time between successive defrost cycles for optimizing the efficiency and reliability of the system, or after a predetermined time interval has elapsed, whichever condition occurs first. During defrost cycle all compressors shall energize, reversing valves shall de-energize, and auxiliary heat shall energize.

4. Unit shall be provided with a factory installed and factory wired 115V, 13 amp GFI convenience outlet disconnect switch in the unit control panel wired prior to unit mounted disconnect switch.

D. Supply Fans

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.

2. Blowers and motors shall be dynamically balanced and mounted on rubber isolators.

3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.

4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be inverter rated where noted on contract drawings.

5. Motors shall be high efficiency electrically communicated motor where noted on contract drawings

E. Cooling Coils

1. Evaporator Coils

a. Coils shall be designed for use with R-454B refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.

b. Coils shall be 6 row high capacity

c. Coils shall have interlaced circuitry and shall be 6 row high capacity.

d. Coils shall be helium leak tested.

e. Coils shall be furnished with factory installed thermostatic expansion valves.

F. Refrigeration System

1. Unit shall be factory charged with R-454B refrigerant.

2. Compressors shall be scroll type with thermal overload protection and independently circuited.

3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.

4. Compressors shall be isolated from the base pan with the compressor manufacturer’s recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.

5. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.

6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter driers.

7. Unit shall include a variable capacity scroll compressor on the refrigeration circuit which shall be capable of modulation from 10-100% of its capacity where noted on contract drawings.

8. Unit shall be two-step scroll type compressor with thermal overload protection and be independently circuited. Two-step compressors shall include 2 stages of capacity control, 65% and 100% where noted on contract drawings.

9. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity where there is more than one compressor indicated where noted on contract drawings.

10. Refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

11. Where there are more than one refrigerant circuits, Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space where there is more than one compressor indicated.

12. Each refrigeration circuit shall be equipped with suction and discharge compressor isolation valves.

13. Each refrigeration circuit shall include adjustable compressor lockouts.

14. Unit shall be configured as an air-source heat pump where indicated on contract drawings. Refrigeration circuit shall be equipped with a factory installed liquid line filter drier with check valve, reversing valve, accumulator, and thermal expansion valves on both the indoor and outdoor coils. Reversing valve shall energize during the heat pump cooling mode of operation.

H. Condensers

1. Air-Cooled Condenser

a. Condenser fans shall be a vertical discharge, axial flow, variable speed direct drive fans.

b. Coils shall be designed for use with R-454B refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes or constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design of copper tubes shall be sine wave rippled.

c. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.

d. Coils shall be helium leak tested.

e. Condenser fans shall be high efficiency electrically commutated motor driven variable speed with factory installed head pressure control module. Condenser airflow shall

continuously modulate based on head pressure and cooling operation shall be allowed down to 35 degree F with adjustable compressor lockout.

I. Gas Heating (where indicated on contract drawings)

1. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.

2. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.

3. Unit shall include a single gas connection and have gas supply piping entrances in the unit base for through-the-curb gas piping and in the outside cabinet wall for across the roof gas piping.

4. Natural gas furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment. Gas heating assemblies shall be capable of operating at any firing rate between 100% and 30% of their rated capacity.

K. Filters

1. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the cooling coil.

2. Unit shall include 1 inch aluminum mesh pre filters upstream of the outside air opening.

3. Units shall include a Magnehelic gauge mounted in the controls compartment.

L. Outside Air/Economizer

1. Units shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 15 CFM of leakage per sq. ft. of damper area when subjected to 2 inches w.g. air pressure differential across the damper. Damper assembly shall be controlled by spring return, DDC actuator. Unit shall include outside air opening bird screen and outside air hood with rain lip and barometric relief dampers.

K. Energy Recovery

1. The factory-installed enthalpy wheel shall be certified to meet the requirements of AHRI Standard 1060 and shall be AHRI listed.
2. The enthalpy wheel shall be constructed of corrugated synthetic fibrous media with a desiccant intimately bound and uniformly and permanently dispersed throughout the matrix structure of the media.

3. The desiccant material shall be molecular sieve, 4 angstrom or smaller.
4. The rotor shall be constructed of alternating layer of flat and corrugated media.
5. Wheel construction shall be fluted or formed honeycomb geometry so as to eliminate internal wheel bypass.
6. The wheel frames shall be evenly spaced steel spokes with a galvanized steel outer band and rigid center hub.
7. The wheel seals shall be full contact nylon brush type.
8. The wheel shall slide out of the cabinet side for service.
9. Wheel cassettes shall be constructed of galvanized steel. Cassettes shall have integral purge section.
10. The wheel bearings shall be inboard mounted permanently sealed roller bearings or externally flanged bearings.
11. The wheel shall be driven by a fractional horsepower AC motor via multilink drive belts.
12. Energy wheel defrost control and air bypass shall be available.

N. Curbs

1. Curbs shall to be fully gasketed between the curb top and unit bottom with the curb providing full cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit. Sides of curbs to be lined with 1inch neoprene coated fiberglass insulation perimeter support, and include a wood nailer.
2. Units with horizontal discharge and return shall have solid bottom curb factory assembled and fully lined with 1 inch neoprene coated fiberglass insulation and include a wood nailer strip.

2.5 CONTROLS

A. Additional field provided and installed Control devices are specified in Section 230900 "Instrumentation and Control for HVAC."

PART 3 - EXECUTION

2.2 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Roof Curb: Install on roof structure, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and

flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

3.3 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

B. Install piping adjacent to RTUs to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in Section 231123 "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Connect supply and return ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Remove packing from vibration isolators.
13. Inspect operation of barometric relief dampers.
14. Verify lubrication on fan and motor bearings.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.

18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.

    a. Measure gas pressure on manifold.
    b. Inspect operation of power vents.
    c. Measure combustion-air temperature at inlet to combustion chamber.
    d. Measure flue-gas temperature at furnace discharge.
    e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.

c. Relief-air volume.
d. Outdoor-air intake volume.

27. Simulate maximum cooling demand and inspect the following:

a. Compressor refrigerant suction and hot-gas pressures.
b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

28. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

a. High-temperature limit on gas-fired heat exchanger.
b. Low-temperature safety operation.
c. Filter high-pressure differential alarm.
d. Economizer to minimum outdoor-air changeover.
e. Relief-air fan operation.
f. Smoke and firestat alarms.

29. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air- distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 237413

SECTION 238126 – SPLIT-SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2013, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IESNA 90.1-2013 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2013, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 COORDINATION

A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 07 Section "Roof Accessories."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion except compressor five years from substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. LG Electronics USA, Inc..
2. Toshiba
3. Daiken

2.2 CONCEALED EVAPORATOR-FAN COMPONENTS

A. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

1. Insulation: Faced, glass-fiber duct liner.
2. Drain Pans: Galvanized steel, with connection for drain; insulated and complying with ASHRAE 62.1-2013.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2013.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

D. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Special Motor Features: Multi-tapped, multispeed with internal thermal protection and permanent lubrication.

E. Filters: Permanent, cleanable.

F. Wiring Terminations: Connect motor to chassis wiring with plug connection.

2.3 EVAPORATOR-FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

1. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2013.
2. Drain Pan and Drain Connection: Comply with ASHRAE 62.1-2013.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Direct drive, centrifugal fan.

D. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Special Motor Features: Multi-tapped, multispeed with internal thermal protection and permanent lubrication.

E. Filters: Permanent, cleanable.

2.4 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: DC Rotary.
2. Variable Compressor speed inverter technology with manual-reset high-pressure switch and automatic-reset low-pressure switch.
3. Refrigerant: R-32.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 0 deg F.

H. Mounting Base: Roof mounted equipment supports.

I. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1-2013, "Energy Standard for Buildings except Low-Rise Residential Buildings."

2.5 ACCESSORIES

A. Thermostat: Hard wired functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection, including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounting compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Install piping adjacent to unit to allow service and maintenance.

B. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect outside air ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring,

switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 238126

SECTION 238127 - VARIABLE REFRIGERANT FLOW SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SYSTEM DESCRIPTION

A. Variable Refrigerant Flow (VRF) HVAC system shall be a variable capacity, direct expansion (DX) heat recovery and heat pump engineered system. The outdoor unit shall consist of one or more cabinet(s) connected through common refrigerant piping. Each system shall have single or multiple, inverter compressor(s). Each system shall be connected to multiple indoor units (ducted, non-ducted or combination thereof) through a common refrigerant piping and integrated system controls. Each indoor unit shall be controlled individually. Additionally heat recovery system shall be capable of simultaneous heating and cooling individual zone(s).

1. Simultaneous Cooling and Heating VRF System: Heat recovery system shall be an air cooled, system consisting of one to three outdoor unit(s) connected to Heat Recovery (HRU) unit(s) and indoor unit(s). Multi-port heat recovery units shall allow simultaneous heating and cooling of individual zone(s).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, sequence of operations and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Organization for Standardization (ISO).

B. All electrical power wiring shall be installed in accordance with the National Electrical Code (NEC) and all applicable state and local building codes.

C. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label and comply with UL 1995 Heat and Cooling Equipment Standard for Safety.

D. All systems must be AHRI 1230 Certified and listed in the certified product directory.

E. The VRF system shall be installed by a licensed mechanical contractor trained by the VRF equipment manufacturer or certified manufacturer's agent. If contractor is not licensed by VRF equipment manufacturer as an approved installer then contractor shall provide written proof of certification prior to the start of installation.

1.7 STORAGE AND HANDLING

A. All VRF equipment shall be stored protected from weather, extreme temperature, etc. as suggested by the manufacturer. All VRF equipment shall be moved, lifted, etc. as suggested by the manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. LG Multi-V VRF
2. Daiken
3. Samsung.

B. Note that Engineer will review in detail submittals for this equipment and will not approve incomplete submittals that do not clearly indicate or include in detail the items indicated to be provided in the above submittal section of this specification. Engineer will not approve submittals that do not meet or exceed all performance and construction requirements indicated

in the specifications and drawings for this project. Any of the three manufacturers products noted above are to be provided by authorized manufacturer's representative companies of the Contractor whom is submitting a proposal. Engineer will not approve submittals that do not come from the authorized manufacturer's representative company for the Contractor whom is submitting a proposal. If authorized manufacturer's representative company for the Contractor is different than authorized manufacturer's representative company of the Engineer then authorized manufacturer's representative company for the Contractor shall contact and coordinate with authorized manufacturer's representative company of the Engineer. If contact and coordination are not performed Engineer will not approve submittals.

2.2 SIMULTANEOUS HEATING AND COOLING OUTDOOR UNIT (TYPE OHRU)

A. Outdoor Unit shall be capable at the following operating ambient air conditions.

1. Heat Recovery System:

    a. Cooling: 14 deg F dry bulb to 122 deg F dry bulb.
    b. Heating: -13 deg F wet bulb to 61 deg F wet bulb.
    c. Cooling based synchronous: 14 deg F dry bulb to 81 deg F dry bulb.
    d. Heating based synchronous: 14 deg F wet bulb to 61 deg F wet bulb.

B. General:

1. The air-conditioning system shall use R32 refrigerant.
2. Each system shall have one, two or three air source outdoor units.
3. Dual and triple frame configurations shall be field piped together using manufacturer's designed and supplied Y-branch kit and field provided interconnecting pipe to form a common refrigerant circuit.
4. Refrigerant circuit configuration for Heat Recovery System

    a. The refrigerant circuit shall be constructed using field provided copper piped together with manufacturer supplied Heat Recovery unit(s) and Y- branches or Header fittings connected to multiple (ducted, non-ducted or combination thereof) indoor units to effectively and efficiently control the simultaneous heating and cooling operation of the VRF system.
    b. Each refrigerant pipe, y-branch, header kit, elbows and valves shall be individually insulated with no air gaps. All joints shall be glued and sealed.

5. Refrigerant circuit configuration for Heat Pump System

    a. The refrigerant circuit shall be constructed using field provided copper piped together with manufacturer supplied Y- branches or Headers connected to multiple (ducted, non-ducted or combination thereof) indoor units to effectively and efficiently control heating or cooling operation of the VRF system.
    b. All refrigerant pipe, y-branch, header kit, elbows and valves shall be individually insulated with no air gaps. All joints shall be glued and sealed.

6. Factory installed microprocessor controls in the outdoor unit(s), HR unit(s), and indoor unit(s) shall perform functions to efficiently operate the VRF system and communicate in a daisy chain configuration between outdoor unit and HR unit(s) and indoor unit(s) via RS485.
7. The system shall be designed to accept connection up to 58 indoor units.
8. The system shall be capable of performing continuous operation when an individual indoor unit is being serviced or power to indoor unit is disconnected.

9. The maximum allowable system combination ratio shall be 130%. Systems designed with combination ratio above 130% are not acceptable.
10. The total nominal capacity of all indoor units shall be no less than 50% and no more than 130% of outdoor unit's nominal capacity to ensure the VRF system will have sufficient capacity to meet the building's cooling and heating load at design day weather conditions.
11. The outdoor unit shall have a fusible plug.
12. The fusible plug shall have a threaded connector.
13. The unit shall be shipped from the factory fully assembled including internal refrigerant piping, compressor, contacts, relay(s), power and communications wiring necessary.
14. Each outdoor unit refrigeration circuit shall have the following components:

    a. Refrigerant strainer(s).
    b. Check valve(s).
    c. Oil separator.
    d. Accumulator.
    e. 4-way reversing valve.
    f. Vapor injection valve.
    g. Variable path valve.
    h. Oil balancing valve for Hi-POR (Available for 12 & 14 ton only).
    i. Oil Level sensor.
    j. Electronic expansion valve(s).
    k. Sub-cooler.
    l. High and low side Schrader valve service ports with caps.
    m. Service valves.

C. Refrigerant Pipe System Design Parameters:

1. The outdoor unit shall be capable of operating at an elevation difference of up to 360 feet above or below the lowest or highest indoor unit respectively.
2. The outdoor unit shall be capable of operating with up to 3280 equivalent length feet of interconnecting liquid line refrigerant pipe in the network.
3. The outdoor unit shall be capable of operating with up to 656 actual feet or 738 equivalent length feet of liquid line refrigerant pipe spanning between outdoor unit and farthest indoor unit.

D. Defrost Operations:

1. The outdoor unit(s) shall be capable of auto defrost operation to melt accumulated frost off the outdoor unit heat exchanger. The defrost cycle control shall be based on outdoor ambient temperatures and outdoor unit heat exchanger temperatures.
2. Split Coil Defrost
3. All single frame units shall have split coil defrost system
4. Split Frame Defrost
5. Multiple frame outdoor units shall be capable of split-frame defrost for 2 out of every 3 defrost cycles, allowing heating mode indoor unit fans to remain on.
6. The third defrost cycle shall switch all outdoor units to defrost mode to fully melt the ice accumulations off the outdoor coil while turning off heat mode indoor unit fans.

E. Oil Management:

1. The system shall have Hi-POR (High Pressure Oil Return) to ensure a consistent film of oil on all moving compressor parts at low speed. Oil is returned to compressor through a separate oil injection pipe.

2. The system shall be provided with a centrifugal oil separator designed to extract oil from the oil/refrigerant gas stream leaving the compressor and return the extracted oil to the compressor oil sump.
3. The system shall have an oil level sensor in the compressor to provide direct oil level sensing.
4. The system shall only initiate an oil return cycle if the oil level is too low.

F. Cabinet:

1. Outdoor unit cabinet shall be made of 20 gauge galvanized steel with an enamel finish.
2. Outdoor unit cabinet finish shall be tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1000 hours.
3. The front panels of the outdoor units shall be removable type for access to internal components.
4. A smaller service access panel, not larger than 6.25"x 6.67" and secured by a maximum of (2) screws shall be provided to access the following:

    a. Service tool connection.
    b. DIP switches.
    c. Auto addressing.
    d. Error codes

5. The cabinet shall have piping knockouts to allow refrigerant piping to be connected at the front or through the bottom of the unit.

G. Fan:

1. Each cabinet shall be equipped with two direct drive variable speed propeller fan(s) with BLDC motor(s) with a vertical air discharge.
2. The fan(s) blades shall be made of Acrylonitrile Butadiene Styrene (ABS) material.
3. The fan(s) motor shall be equipped with permanently lubricated bearings.
4. The fan motor shall be variable speed with a maximum operating speed of 1050 RPM.
5. The fan shall have a raised guard to help prevent contact with moving parts.
6. The cabinet shall have option to change the discharge air direction from vertical to horizontal using optional factory provided air guides.
7. The cabinet shall have DIP switch setting to raise external static pressure up to 0.32 in-wg.

H. Coil:

1. The outdoor unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.
2. The copper tubes shall have inner groves.
3. The aluminum fins shall have factory applied corrosion resistant GoldFin™ material.
4. Coil coating shall be tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1000 hours
5. The outdoor unit coil shall be tested to a pressure of 551 psig.
6. The coil for each cabinet shall have 14 Fins per Inch (FPI).
7. All the outdoor units shall have a 3 rows heat exchanger.
8. The cabinet shall have a coil guard.

I. Compressor(s):

1. Each cabinet shall be equipped with two hermetically sealed, inverter driven, digitally controlled scroll compressors.
2. Each inverter driven, digitally scroll compressor shall be capable of operating in a frequency range from 15 Hz to 150 Hz with control in 0.5 Hz increments.
3. The compressor(s) shall be equipped with a 60 Watt crankcase heater.
4. The compressor shall use a factory charge of Polyvinyl Ether (PVE) oil.
5. The compressor bearing(s) shall have Teflon™ coating.
6. The continuous operating range shall be

    a. Cooling: 14°F to 119°F (DB)
    b. Heating: 13°F to 75°F (WB)

7. The compressor(s) shall be protected with:

    a. High Pressure switch
    b. Over-current /under current protection
    c. Phase failure
    d. Phase reversal

J. Electrical:

1. The outdoor unit electrical power shall be 208V, 60 Hz, 3 phase.
2. The outdoor unit shall be capable of operation within voltage limits of +/- 10% rated voltage.
3. The outdoor unit shall be controlled by integral microprocessors.

K. Sound Levels:

1. Each cabinet shall be rated with a sound level not to exceed 59.5 dB(A) when tested in an anechoic chamber under ISO3745 standard.

L. Sensors:

1. Each single cabinet shall have:

    a. Suction temperature sensor.
    b. Discharge temperature sensor.
    c. High Pressure sensor.
    d. Low Pressure sensor.
    e. Outdoor temperature sensor.
    f. Outdoor unit heat exchanger temperature sensor.

M. Controls:

1. The control circuit between the indoor units, heat recovery box and the outdoor unit shall be 24VDC completed using a 2-conductor, stranded, and shielded cable for the RS485 daisy chain communication.

2. The system shall be furnished with a Central Controller for system management and administration and shall be its own web based IP system. The system will integrate DOAS-1 in its controls.

2.3 HEAT RECOVERY (HR) UNITS FOR SIMULTANEOUS HEATING AND COOLING SYSTEMS (TYPE IHRU)

A. General:

1. HR unit shall be designed and manufactured by the same manufacturer of VRF indoor unit(s) and outdoor unit(s).
2. HR unit casing shall be made with galvanized steel.
3. HR unit shall require 208-230V/1-phase/60Hz power supply.
4. HR Unit shall be an intermediate refrigerant control device between the air source out- door unit and the indoor units to control the systems simultaneous cooling and heating operation.
5. HR unit shall be engineered to work with a three pipe VRF system comprising of:

    a. High Pressure Vapor Pipe
    b. Low Pressure Vapor Pipe
    c. Liquid Pipe

6. HR unit shall be designed to be piped in series with the use of Y-branch or header fittings.
7. HR unit shall have 2, 3 or 4 ports.
8. Each port shall be capable of operating in cooling or heating independently regardless of the operating mode of any other port on the HR unit or in the system.
9. Each port shall be capable of connecting from 1 to 8 indoor units to a maximum nominal capacity of 54MBh.
10. Maximum nominal capacity per HR unit shall not exceed 192MBh.
11. Indoor units greater than 54MBh nominal capacity shall be twinned using a reverse Y-branch.
12. HR unit shall be internally piped, wired, assembled and run tested at the factory.
13. HR unit shall be designed for installation in a conditioned environment.
14. HR unit shall have a liquid bypass valve.
15. HR unit shall have (2) two-position solenoid valves per port.
16. HR unit shall have a balancing valve to control the pressure between the high pressure and low pressure pipe during mode switching.
17. HR unit shall have an electronic expansion valve for subcooling.
18. HR unit shall not require a condensate drain.
19. HR unit shall be internally insulated.
20. All field refrigerant lines between outdoor unit and HR unit and from HR unit to indoor unit shall be field insulated.
21. The HR unit shall not exceed a net weight of 49 lbs.
22. The system shall be designed to accommodate 16 HR units connected to Heat Recovery units piped in single series string.
23. A single series pipe string of 1 to 16 HR units shall be capable of serving indoor units with a total nominal capacity of 192 MBH.Heat Recovery Unit Construction:

B. Piping Capabilities:

1. The acceptable piping length between HR unit(s) and indoor unit(s) shall be 131 equivalent length feet.
2. The acceptable elevation difference between each HR unit and each indoor unit and between (2) HR units shall not exceed 131 feet.
3. The acceptable elevation difference between two series connected HR units shall be 16 feet.

C. Controls:

1. HR unit(s) shall have factory installed unit mounted control boards and integral microprocessor to communicate with other devices in the VRF system.
2. HR unit shall be connected to the air source unit and indoor unit in a control circuit with 24VDC using a 2-conductor shielded cable for RS485 daisy chain communication.
3. The VRF manufacturer shall provide published documentation that specifically allows the installation of field provided isolation valves on all pipes connected to the Heat Recovery unit to allow the servicing of HR units refrigerant circuit or the replacement of HR unit without evacuating the balance of the piping system.

2.4 4-WAY CEILING CASSETTE INDOOR UNIT (TYPE CC)

A. General:

1. Unit shall be factory assembled, wired, piped and run tested.
2. Unit shall be designed to be installed for indoor application.
3. Unit shall be designed to mount recessed in the ceiling and has a surface mounted concentric grille on the bottom of the unit.
4. The unit shall be available in both 2’ x 2’ and 3’ x 3’ chassis.
5. Unit shall be capable to be installed with heat pump or heat recovery or cooling VRF system.

B. Casing and Panel:

1. Unit case shall be manufactured using galvanized steel plate.
2. The unit shall be provided with an off-white Acrylonitrile Butadiene Styrene (ABS) polymeric resin architectural grille.
3. The grille shall have a tapered trim edge, and a hinged, spring clip (screw-less) return air filter-grille door.
4. Unit shall be provided with metal ears designed to support the unit weight on four corners.
5. Ears shall have pre-punched holes designed to accept field supplied all thread rod hangers.

C. Cabinet Assembly:

1. Unit shall have four supply air outlets and one return air inlet.
2. The supply air outlet shall be through four-directional slot diffuser each equipped with independent oscillating motorized guide vane designed to change the airflow direction.
3. The grille shall have a discharge range of motion of 40° in an up/down direction with capabilities of locking the vanes.
4. The unit shall have a guide vane algorithm designed to sequentially change the predominant discharge airflow direction in counterclockwise pattern.
5. Guide vanes shall provide airflow in all directions.
6. Unit shall be equipped with factory installed temperature thermistors for

    a. Return air.
    b. Refrigerant entering coil.
    c. Refrigerant leaving coil.

7. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.

8. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
9. The unit shall have factory designated branch duct knockouts on the unit case.
10. The unit shall have provision of fresh air ventilation through a knock-out on the cabinet.
11. The branch duct knockouts shall have the ability to duct up to one-half the unit airflow capacity.
12. The branch duct cannot be ducted to another room.
13. Unit shall have the following functions as standard

    a. Self-diagnostic function.
    b. Auto restart function.
    c. Auto changeover function (Heat Recovery system only).
    d. Auto operation function.
    e. Child lock function.
    f. Forced operation.
    g. Dual thermistor control.
    h. Sleep mode.

D. Fan and Motor Assembly:

1. The unit shall have a single direct driven turbo fan.
2. The fan shall be made of high strength ABS HT-700 polymeric resin.
3. The fan motor is Brushless Digitally controlled (BLDC) with permanently lubricated and sealed ball bearings.
4. The fan/motor assembly shall be mounted on vibration attenuating rubber grommets.
5. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm.
6. In cooling mode, the indoor fan shall have the following settings: Super Low, Low, Med, High, Power Cool and Auto.
7. In heating mode, the indoor fan shall have the following settings: Super Low, Low, Med, High and Auto.
8. The Auto fan setting shall adjust the fan speed to most effectively achieve the set-point.
9. Unit shall have factory installed motorized louver to provide flow of air in up and down direction for uniform airflow.

E. Filter:

1. The return air inlet shall have a factory supplied primary removable, washable filter.
2. The filter access shall be from the bottom of the unit.

F. Coil:

1. Unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.
2. Unit shall have minimum of 2 rows of coils.
3. Unit shall have a factory supplied condensate drain pan below the coil.
4. Unit shall have provision of 45° flare refrigerant pipe connections
5. The coil shall be factory pressure tested at a minimum of 551 psig.
6. All refrigerant piping from outdoor unit or Heat Recovery (HR) unit to indoor unit shall be field insulated.

G. Condensate Pump:

1. Unit shall have a factory installed and wired condensate drain pump capable of providing minimum 27.5 inch lift from bottom surface of the unit.

2. The drain pump shall have a safety switch to shut off the unit if condensate rises too high in the drain pan.

H. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 Hz.
2. The indoor unit shall be capable of operation within voltage limits of +/-10% rated voltage.

I. Controls:

1. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS485 daisy chain.
2. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system in an override capability only with +/- 3 deg F from front end provided setpoint.
3. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, 2 core, stranded and shielded communication cable.
4. The unit controls shall operate the indoor unit using one of the five operating modes:

a. Auto changeover.
b. Heating.
c. Cooling.
d. Dry.
e. Fan only.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s).

D. Install all controls and control wiring noted above and required for a complete fully correctly functioning VRF system. This to include time required for programming of the system to provide a system manufacturer sequence of operation to be submitted and approved by Engineer.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized and factory-employed service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized and factory-employed service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Engage a factory-authorized and factory-employed service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.4 DEMONSTRATION

A. Engage a factory-authorized and factory-employed service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238127

SECTION 238219 – INDOOR AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes indoor air handling units and accessories with the following heating and cooling features:

1. DX Heat Pump coil.
2. Electric Heat

1.3 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories for each unit type and configuration.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Plans, elevations, sections, and details.
2. Details of anchorages and attachments to structure and to supported equipment.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and maintenance data.

E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IESNA 90.1-2007 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of compressor that fail in materials or workmanship within specified warranty period.

C. Warranty Period: Two years from date of Substantial Completion.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Furnish one spare filter for each filter installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AAON
2. Engineer approved equal.

B. Other comparable products by the other manufacturers other than the basis of design product must meet or exceed all performance, construction and capacity criteria of the basis of design product. This will be reviewed in detail by Engineer during the submittal process.

2.2 Air-Handling Units

A. General Description

1. Air-handling unit shall include DX evaporator coils, filters, supply fans, dampers, electric heaters, reheat coil, mixing box, and unit controls.

2. Unit shall have a draw-through supply fan configuration and discharge air horizontally.

3. Unit shall be factory assembled and tested including leak testing of the coils and run testing of the supply fans.

4. Unit shall have decals and tags to indicate lifting and rigging, service areas, and caution areas for safety and to assist service personnel.

5. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.

6. Installation, Operation and Maintenance manual shall be supplied within the unit.

7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's access door.

8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's access door.

A. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.

2. Unit insulation shall have a minimum thermal resistance R-value of 6.25. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.

3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.

4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Sealing shall be included between panels and between access doors and openings to reduce air leakage. Refrigerant piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

5. Access to filters, cooling coil, reheat coil, heating coil, supply fans, and electrical and controls components shall be through hinged access doors. Access doors shall be flush mounted to cabinetry. Coil access door and supply fan access door shall include quarter-turn lockable handles. Supply fan access door shall include removable pin hinges.

6. Units with cooling coils shall include a sloped 304 stainless steel drain pans. Drain pan connection shall be on the either side of the unit.

7. Cooling coils shall be mechanically supported above the drain pan by multiple supports that allow drain pan cleaning and coil removal.

8. Unit shall include interior corrosion protection which shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure. Air tunnel, fans and dampers shall all include the corrosion protection.

B. Electrical

1. Unit shall be provided with standard power block for connecting power to the unit.

2. Unit shall include a factory installed 24V control circuit transformer.

3. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

4. Air-source heat pump where indicated on contract drawings shall include an optimized start defrost cycle to prevent frost accumulation on the outdoor coil during heat pump heating operation and to minimize defrost cycle energy usage. If the temperature of the outdoor heat exchanger and/or the suction line is less than a predetermined value, a deferred defrost cycle is initiated wherein the defrost cycle starts after a variable, continuously optimizing, time interval has elapsed. The defrost cycle is terminated when the relative temperatures of the outdoor heat exchanger and/or the suction line indicate that sufficient frost is melted from the heat exchanger to insure adequate time between successive defrost cycles for optimizing the efficiency and reliability of the system, or after a predetermined time interval has elapsed, whichever condition occurs first. During defrost cycle all compressors shall energize, reversing valves shall de-energize, and auxiliary heat shall energize.

C. Supply Fans

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.

2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.

3. Motor shall be a high efficiency electronically commutated motor (ECM). ECM driven supply fan cfm setpoint shall be set with factory installed potentiometer within the control compartment.

D. Cooling Coil

1. Evaporator Coil

   a. Coil shall be designed for use with R-454B refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.

   b. Coil shall have two circuits and interlaced circuitry.

   c. Coil shall be helium leak tested.

   d. Coil shall be furnished with factory installed thermostatic expansion valves. The sensing bulbs shall be field installed on the suction line immediately outside the cabinet.

e. Coil shall have external piping connections. Liquid, suction, hot gas reheat, and hot gas bypass connections shall be sweat connection. Coil connections shall be labeled, extend beyond the unit casing and be factory sealed with grommets that cover both the interior and exterior of the unit casing, to minimize air leakage and condensation inside the panel assembly.

E. Refrigeration Systems

1. Air handling unit and matching condensing unit shall be capable of operation as an R-454B split system air conditioner.

2. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.

3. Modulating hot gas reheat shall be provided on the refrigeration circuit. Refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Modulating reheat valves shall be factory installed in the matching condensing unit. Reheat line connections shall be labeled, extend beyond the unit casing and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.

4. Modulating hot gas reheat shall be provided on the lead refrigeration circuit. Refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Modulating reheat valves shall be factory installed in the matching condensing unit. Reheat line connections shall be labeled, extend beyond the unit casing and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.

5. Unit shall be configured as an air-source heat pump where indicated on contract drawings. Refrigeration circuit shall be equipped with a factory installed liquid line filter drier with check valve, reversing valve, accumulator, and thermal expansion valves on both the indoor and outdoor coils. Reversing valve shall energize during the heat pump cooling mode of operation.

I. Electric Heating (Where Indicated On Contract Drawings)

1. Unit shall include an electric heater consisting of electric heating coils, fuses and a high temperature limit switch, with capacities as shown on the plans.

2. Electric heating coils shall be located in the reheat position downstream of the cooling coil.

3. Electric heater shall have full modulation capacity controlled by an SCR (Silicon Controlled Rectifier). A 0-10 VDC heating control signal shall be field provided to control the amount of heating.

4. Emergency electric heating capacity shall be sized by determining the maximum electric heating capacity not to exceed the amp draw of all compressors and adding that electric heating capacity to the auxiliary electric heating capacity. Auxiliary electric heating capacity shall be sized to meet heating leaving air temperature setpoint when heat pump heating is in operation

F. Filter Compartment

1. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the cooling coil.

2. Unit shall include a clogged filter switch.

A. Controls
1. Refer to and comply with requirements found in contract drawngs.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive air handling units for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping and electrical connections to verify actual locations before unit ventilator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install air handling unit’s level and plumb.

B. Install air handling units to comply with NFPA 90A.

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install guards on thermostats in the following locations:

1. Entrances.
2. Public areas.
3. Where indicated.

E. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

H. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."

I. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

J. Install electronic and fiber-optic cables according to NEC 2009 Guidelines.

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Ground equipment.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

F. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

G. Install signal and communication cable as follows:

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

H. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

I. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect test, and adjust. Field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check control valves. Verify that they are in correct direction.
8. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
9. Check DDC system as follows:

a. Verify that DDC controller power supply is from emergency power supply, if applicable.
b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
c. Verify that spare I/O capacity has been provided.
d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 CLEANING

A. After installing units, inspect unit cabinet for damage to finish. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. After installing units, clean air handling units internally according to manufacturer's written instructions.

C. Install new filters in each unit within two weeks after Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized and factory-employed service representative to train Owner's maintenance personnel to adjust, operate, and maintain air handling units.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 238219

SECTION 238236 - FINNED-TUBE RADIATION HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes electric baseboard radiation heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include details and dimensions of custom-fabricated enclosures.
4. Indicate location and size of each field connection.
5. Indicate location and arrangement of piping valves and specialties.
6. Indicate location and arrangement of integral controls.
7. Include enclosure joints, corner pieces, access doors, and other accessories.
8. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members, including wall construction, to which finned-tube radiation heaters will be attached.
2. Method of attaching finned-tube radiation heaters to building structure.
3. Penetrations of fire-rated wall and floor assemblies.

B. Field quality-control reports.

C.

PART 2 - PRODUCTS

2.1 ELECTRIC BASEBOARD RADIATION HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Vulcan
2. Sterling.
3. QMark.

B. Description: Factory-packaged units constructed according to UL 499, UL 1030, and UL 2021.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Heating Elements: Nickel-chromium-wire heating element enclosed in metallic sheath mechanically bonded to fins, with high-temperature cutout and sensor running the full length of the element. Element supports shall eliminate thermal expansion noise.

D. Element Supports: Ball-bearing cradle type to permit longitudinal movement on enclosure brackets.

E. Front Panel: Minimum 0.0428-inch thick steel.

F. Wall-Mounted Back Panel: Minimum 0.0329-inch thick steel, full height, with full-length channel support for front panel without exposed fasteners.

G. Support Brackets: Locate at maximum 36-inch spacing to support front panel and element.

H. Finish: Baked-enamel finish in manufacturer's standard color as selected by Architect.

I. Enclosure Style: Flat top.

1. Flat Top Outlet Grille.

J. Unit Controls: Integral line-voltage thermostat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive finned-tube radiation heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before installation of finned-tube radiation heaters.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BASEBOARD RADIATION HEATER INSTALLATION

A. Install units level and plumb.

B. Install enclosure continuously around corners, using outside and inside corner fittings.

C. Join sections with splice plates and filler pieces to provide continuous enclosure.

D. Install access doors for access to valves.

E. Install enclosure continuously from wall to wall.

F. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.

3.3 CONNECTIONS

A. Ground electric finned-tube radiation heaters according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 238236

SECTION 238239 – UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Wall heaters with propeller fans and electric-resistance heating coils.
2. Ceiling heaters with propeller fans and electric-resistant heating coils.
3. Propeller unit heaters with electric-resistance coils.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CWP: Cold working pressure.

C. PTFE: Polytetrafluoroethylene plastic.

D. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Plans, elevations, sections, and details.
2. Location and size of each field connection.
3. Details of anchorages and attachments to structure and to supported equipment.
4. Equipment schedules to include rated capacities, operating characteristics, furnished specialties, and accessories.
5. Location and arrangement of piping valves and specialties.
6. Location and arrangement of integral controls.
7. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For unit heaters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2007 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6 - "Heating, Ventilating, and Air-Conditioning."

PART 2 - PRODUCTS

2.1 WALL & CEILING HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berko Electric Heating; a division of Marley Engineered Products.
2. Chromalox, Inc.; a division of Emerson Electric Company.
3. Marley Electric Heating; a division of Marley Engineered Products.
4. QMark Electric Heating; a division of Marley Engineered Products.

B. Description: An assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

C. Cabinet:

1. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners, and tamperproof thermostat.
2. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

D. Surface-Mounting Cabinet Enclosure: Steel with finish to match cabinet.

E. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high temperature protection. Provide integral circuit breaker for overcurrent protection.

F. Fan: Aluminum propeller directly connected to motor.

1. Motor: Permanently lubricated, multispeed. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

G. Controls: Unit-mounted thermostat.

H. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

2.2 ELECTRIC PROPELLER UNIT HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berko
2. Markel Products Company.
3. Sigma
4. QMark

B. Description: An assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

C. Comply with UL 2021.

D. Comply with UL 823.

E. Cabinet: Removable panels for maintenance access to controls.

F. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heater before shipping.

G. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

H. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.

B. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

C. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Type: Permanently lubricated.

D. Control devices and operational sequences are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Refer to these sections for additional requirements for unit manufacturer provided controls and ATC contractor provided controls.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping and electrical connections to verify actual locations before unit heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Division 07 Section "Joint Sealants."

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with all-thread hanger rods and spring hangers with vertical-limit stop. Hanger rods and attachments to structure are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

D. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

E. Suspend propeller unit heaters from structure with all-thread hanger rods and spring hangers with vertical-limit stop. Hanger rods and attachments to structure are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Division 23 Section "Vibration and Controls for HVAC Piping and Equipment."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Comply with safety requirements in UL 1995.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 238239

SECTION 238240 - CABINET UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cabinet unit heaters with centrifugal fans and electric resistance heating.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CWP: Cold working pressure.

C. PTFE: Polytetrafluoroethylene plastic.

D. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include location and size of each field connection.
4. Include details of anchorages and attachments to structure and to supported equipment.
5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
6. Indicate location and arrangement of piping valves and specialties.
7. Indicate location and arrangement of integral controls.
8. Wiring Diagrams: Power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which cabinet unit heaters will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.

6. Perimeter moldings for exposed or partially exposed cabinets.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cabinet Unit-Heater Filters: Furnish one spare filter(s) for each filter installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Berko; Marley Engineered Products.
2. Markel Products Company; TPI Corporation.
3. Marley Engineered Products.
4. QMark; Marley Engineered Products.

2.2 DESCRIPTION

A. Factory-assembled and -tested unit complying with AHRI 440.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 2021.

2.1 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.2 COIL SECTION INSULATION

A. Insulation Materials: ASTM C 1071; surfaces exposed to airstream shall have aluminum-foil facing to prevent erosion of glass fibers.

1. Thickness: 1/2 inch.
2. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.
3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
4. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.3 CABINETS

A. Material: Steel with baked-enamel finish with manufacturer's custom paint, in color selected by Architect.
1. Horizontal Unit, Exposed Bottom Panels: Minimum 0.0528-inch- thick sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
2. Vertical Unit, Front Panels: Minimum 0.0528-inch- thick sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
3. Recessed Flanges: Steel, finished to match cabinet.
4. Control Access Door: Key operated.

2.4 FILTERS

A. Minimum Arrestance: According to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Pleated: 90 percent arrestance and MERV 7.

2.5 COILS

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.

2.6 CONTROLS

A. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal, directly connected to motor; thermoplastic or painted-steel wheels and aluminum, painted-steel, or galvanized-steel fan scrolls.
2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
3. Wiring Terminations: Connect motor to chassis wiring with plug connection.

B. Basic Unit Controls:

1. Control voltage transformer.
2. Integral thermostat with the following features:

a. Heat-off switch.
b. Concealed set point.
c. Concealed indication.
d. Deg F indication.

C. Electrical Connection: Factory-wired motors and controls for a single field connection.

D. No integration with the building automation system is required; local controls only.

2.7 CAPACITIES AND CHARACTERISTICS

A. Cabinet:

1. Horizontal, Fully Recessed:

a. Air Inlet: punched louver.
b. Air Outlet: punched louver.

Vertical, Surface floor mount:

a. Air Inlet: punched louver.
b. Air Outlet: punched louver.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping and electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cabinet unit heaters to comply with NFPA 90A.

B. Suspend cabinet unit heaters from structure with elastomeric hangers.

C. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

3.3 CONNECTIONS

A. Comply with safety requirements in UL 1995.

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

END OF SECTION 238240

SECTION 260000 – ELECTRICAL SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and other Divisions Specification Sections, apply to this Section.

B. The requirements of all other sections of Division 26, 27 and 28 apply to this section.

1.2 WARRANTY FOR PROJECT

A. The Contractor shall provide the Owner with a 2-year warranty on all materials, labor and systems from the date of Substantial Completion for each Phase. The date of Substantial completion will be as set in a letter issued by the Architect.

1.3 DEFINITIONS

A. For a complete list of definitions for this contract refer to the Division 1 specifications.

B. Provide: Means to provide, install and make the equipment/system completely functional and operational with testing, commissioning and training.

C. Install: Means to provide, install and make the equipment/system completely functional and operational with testing, commissioning and training.

1.4 SCOPE OF WORK

A. Work Included: It is the intent of these specifications and the accompanying drawings that the Contractor shall, unless otherwise specified herein, furnish all labor, materials, tools, and equipment necessary, together with the necessary accessories to constitute a satisfactory and complete installation, to complete the installation of the electrical work, as indicated on the drawings and described hereinafter. The Contractor shall properly install, equip, adjust and put in perfect condition, the respective portions of the work specified, and to so interconnect the various items or sections of the work to form a complete and properly operating whole. The work shall consist of, but shall not necessarily be limited to the following for the William Penn Charter School - New Lower School.

1. General:
    a. Contractor shall provide temporary lighting and GFCI construction power.
    b. For detailed scope of work for each electrical system, refer to the respective Division 26, 27 & 28 specification sections.
    c. Provide excavation, backfill, compaction and resurfacing to match the existing surface finish (i.e. asphalt, concrete, grass, etc.) based on the existing site and as required in these specifications and shown on contract drawings.
    d. Provide and install new grounding system per 2020 NEC.
    e. Testing and balancing of Electrical system.
    f. All necessary rigging.

g. Removal of trash and general clean-up.
h. All necessary permits, approvals, fees, etc.
i. Instructions to the Owner.
j. Cutting, patching and clean-up.
k. The contractor shall employ the services of the local Underwriters' Inspection Agency and pay for all associated fees.

2. Scope of Work:
a. Refer to Drawing E-001 for Contractor Responsibility Chart.
b. Refer to front end specifications for description and details of Alternate Bids for this project.
c. Provide and install new fire pump lockable fused disconnect at exterior switchboard and tap switchboard with new feeder. Install feeder underground into crawlspace below building and transition to fire-rated mineral insulated cable to fire pump room.
d. Provide and install (2) new separate communications ductbank with 4” conduits from two different utility poles to the new building MDF room.
e. Provide and install new pad mounted outdoor natural gas fired emergency generator, including pad and all conduit and wiring from the electrical room to the generator for a complete and fully functional emergency supply system.
f. Provide and install new generator quick-connect cabinet on the building exterior.
g. Provide and install new indoor optional standby ATS with external surge suppression.
h. Provide and install new indoor Life Safety ATS with external surge suppression. Prior to releasing equipment, the contractor is required to provide a selectively coordinated life safety system for all applicable breakers, as noted on the drawings.
i. Provide and install new panelboards for the emergency distribution system, including conduits, cables. All conduits and wiring for the life safety system shall be separated as per the NEC requirements.
j. Provide and install new conduits and feeders to new electrical panels.
k. Provide and install new power distribution and lighting appliance panelboards.
l. Provide and install new wiring devices and backboxes.
m. Provide new digital lighting control system room controllers, with 0-10V dimming via wall stations, where indicated on plans, as well as low-voltage 0-10V and branch circuit wiring to each associated fixture. Lighting controls shall incorporate receptacle control.
n. Provide new interior normal/emergency lighting, with fixtures wired to generator panels via UL924 relays to allow for normal lighting control and emergency operation.
o. Provide and install new lighting fixtures, exit signs, wiring, conduit and lighting controls.
p. Provide and install new exterior building mounted lighting fixtures, conduit, wiring and controls.
q. Provide and install complete telecom infrastructure IT Plant system, including but not limited to, wiring, jacks, patch panels, racks, conduit and backboxes.
r. Security equipment to be provided by University’s Security Vendor, to be installed, and wired by contractor, including but not limited to, wiring, jacks, patch panels, racks, conduit and backboxes.
s. Provide and install, conduit and backboxes to all equipment documented in the AV drawings. Wiring and equipment will be installed by University’s Vendor, Contractor

is required to coordinate all related conduit and backbox work with University's Vendor in the field prior to installation.

t. Provide and install new initiation and notification fire alarm devices and equipment, including cabling, detectors, strobes, horn/strobes, pull stations, etc. Remove and reinstall, or relocate devices as indicated on plans where necessary for construction activities. Entire fire alarm system shall be tested at the completion of the project per NFPA 72, to ensure all devices are fully functional. Contractor to replace all fire alarm wiring from the fire alarm control panel to new, relocated, and existing fire alarm devices within the renovation area. Shop drawings should show this new wiring, including new notification zones/circuits.

u. Existing EST-3 fire alarm control panel is to be replaced with new EST-4 and relocated to the first floor electrical room. All fire alarm wiring serving existing to remain areas shall be spliced and extend to new fire alarm panel location. Shop drawings should show all existing zones and devices, for a full complete floor plans and riser diagrams of the entire system.

v. Provide and install wiring and final connections to all equipment in Architectural Specifications requiring electrical service.

w. Provide and install wiring for all mechanical, plumbing, fire protection and architectural equipment on the project. Provide and install NEC require disconnecting means for all required equipment and locations.

B. It will be the responsibility of the Contractor to examine all Drawings (Architectural, Structural, Civil, Fire Protection, Mechanical, Plumbing and Electrical) to determine the full extent of the work. All field measurements and verifications of conditions and materials will be the obligation of the Contractor. The submission of a Proposal by the Contractor will be considered an indication that all work has been included in the Proposal. It will also be considered an indication that a thorough review of conditions, materials, and all related specifications have been investigated by the Contractor, and the results of such investigations have been included in the Contractor's Proposal.

C. Coordination Between Mechanical (MC), Electrical (EC) and Plumbing (PC) Contractors:

1. The Electrical Contractor shall:

a. Receive and set the motor starters as provide by the Mechanical and Plumbing Contractors.

b. Provide power wiring, including final connection of same, from source to starters or contactors to motors.

c. Receive and install the wall-mounted electrical control devices, thermal switches, etc., and provide all wiring for same.

d. Provide all fused or unfused disconnect switches and circuit breakers not supplied as part of the HVAC system and as required by the National Electrical Code, or as shown on the drawings, or as specified.

e. Adjust connections to electrical motors to insure proper rotation.

f. Provide duct detectors and tubes to the MC for installation in the ductwork. EC shall wire and program the duct detectors and remote test stations into the fire alarm system. MC shall wire from the detectors into the HVAC equipment for shut- down.

g. Provide 120V to junction boxes for the MC to install 120-24V transformers. EC to receive the transformer from the MC and install & wire up the 120V side of the transformer. MC shall provide all 24V wiring.

h. Provide 120V to junction boxes for the PC provided low-voltage 120-24V transformers. EC to receive the transformer from the PC and install & wire the transformer. EC shall install conduit in walls for all 24V powered plumbing fixtures – conduits shall be routed to backbox to above the finished ceiling from back boxes for each plumbing fixture. Coordinate with PC.

2. The Mechanical Contractor will:

a. Furnish and set all motors for mechanical equipment.
b. Furnish all motor starters, starter/disconnects, HVAC unit mounted disconnects, contactors, pushbuttons and switches for local and remote control of all HVAC equipment and turn over to the Electrical Contractor for installation.
c. Provide pre-wired control panels, including relays, switches, pilot lights, etc., all as shown and/or specified, complete with wiring to numbered terminal strips.
d. Furnish and install duct and pipe-mounted control devices, such as freezestats, aquastats, flow switches, etc.
e. Furnish wiring diagrams for the systems, in sufficient time to allow roughing-in of conduit in accordance with the proposed work schedule.
f. Provide all control wiring including 120V controls, 120V power and 120/24V control power transformers as required for a complete and fully functional HVAC DDC control system. The MC is required to provide 120V power to their HVAC DDC control panels and system.
g. Provide 120V-24V transformers to the EC for mounting and wiring.
h. Receive duct detectors from the EC and install in the ductwork. MC shall provide and install all shut-down and system activation wiring from the smoke detectors to the respective HVAC units.

3. The Plumbing Contractor will:

a. Furnish and set all motors for plumbing equipment.
b. Coordinate locations of all equipment with both the Mechanical and Electrical Contractors.
c. Provide the Electrical Contractor with information and instructions for connection of electrical service to water coolers, domestic hot water heater, etc.
d. Provide and install 120V to 24V control power transformers for the electronic sensors associated with the Water Closets, Lavatories and Urinals. PC shall provide and install all 24V wiring from the transformers to all fixtures. EC will only provide 120V connection to the transformer.

4. The Electrical Contractor shall examine the drawings and read the specifications for the mechanical trades, and shall note all motor-driven equipment, starters and control apparatus noted, shown or specified herein.

D. Architectural Equipment Wiring and Connections:

1. All equipment for will be furnished and set by the Equipment Contractor.
2. The Electrical Contractor shall run all electrical conduit and wiring to each piece of equipment requiring electrical service and shall make all final connections to the equipment.
3. The equipment and required wiring connections are shown on the drawings.
4. This Electrical Contractor shall furnish disconnect switches at the various pieces of equipment as required by the NEC.

1.5 WARRANTY

A. Contractors shall note that all equipment warranties, as described in the various sections of the Specifications, will begin after Substantial Completion. It will not make any difference when equipment is ordered, delivered or installed, warranties will commence after the Architect issues his letter of “Substantial Completion.”

B. All equipment is to include factory start-up unless the Contractor receives written permission, from the Owner, for Contractor start-up. Copies of the start-up report must be included with the Request for Final Payment, otherwise final payment will be withheld until the factory reports are submitted.

C. All equipment furnished for this Project shall include a 2 year warranty on parts and labor.

PART 2 - PRODUCTS (Not applicable).

PART 3 - EXECUTION (Not applicable).

END OF SECTION 260000

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Link Seal.
d. Metraflex Co.
e. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular

space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals. Link-Seal modular, elastomer sealing system shall be used for existing walls in underground situations with no sleeve.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping." Refer to the Architectural drawings for locations of all fire-rated floor and wall assemblies.

END OF SECTION 260500

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

B. Refer to Section 3.2 for allowable conduit and MC cable locations.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70,

Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Senator Wire & Cable Company.
4. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70. All conductors on the project shall be copper, unless specifically noted as aluminum on the drawings.

C. Aluminum Conductors (only where specifically noted and allowed as shown on the drawings): Aluminum, complying with ASTM B 800 and ASTM B 801.

D. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN. Conductor sizes #12 and #10 shall be solid and #8 and larger shall be stranded.

E. Type MC Cable: Aluminum armor with copper conductors. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

B. Underground Feeders: Type XHHW, single conductors in Type PVC schedule 40 UL listed conduit. Refer to drawings for ductbanks requiring encasement in 3” of concrete.

C. Feeders Concealed in Ceilings, Walls, Partitions: Type THHN-THWN, single conductors in raceway.

D. Use the following wiring methods as indicated for all branch circuits:
1. Outdoor, underground: Type PVC schedule 40 UL listed conduit. Refer to drawings for ductbanks requiring encasement in 3” of concrete.
2. Indoor, Type THHN-THWN, single conductors in raceway:
a. Mechanical rooms.
b. Electrical rooms.

a. Sprinkler rooms.
b. Elevator machine rooms.
c. Above hard / drywall ceilings.
d. Corridors.
e. Rooms with exposed ceiling structure.
f. In concrete block walls.

3. In areas listed above in D2, MC cable jumpers to equipment is acceptable. Maximum MC cable jumper lengths to equipment shall be 6’. Type MC aluminum-clad multi- conductor copper cabling with ground.
4. Indoor, concealed in drywall walls and accessible ceilings and not in areas listed above in D.2: Type MC aluminum-clad multi-conductor copper cabling with ground.

E. Dimming Lighting Branch Circuits: Where branch circuit wiring is routed to 0-10V dimming light fixtures and switches, UL listed metalclad type MC-PCS (Luminary) cable. Where required to be in raceway as per D.2 above, in addition to the phase, neutral and ground wires, provide additional 2#16 AWG solid TFN Twisted jacketed pair (purple/gray) rated at 600V for 0-10V controls.

F. Class 1 Control Circuits: Type MC Cable.

G. Class 2 Control Circuits: Type MC Cable.

H. Fire Alarm: Type MC FPLP cabling where concealed in walls, cable tray, accessible ceilings, exposed ceilings and partitions and Type THHN-THWN, in raceway where exposed as outlined in D.2 above.

I. INSTALLATION OF CONDUCTORS AND CABLES

J. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

K. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

L. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

M. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

N. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

O. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

P. Common neutrals shall not be used. Provide individual, dedicated neutral for each circuit.

Q. Common grounds are acceptable, in accordance with the NEC.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors for compliance with requirements.

    a. Megger testing for 600V feeder conductors.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning cabling and retest as specified above.

END OF SECTION 260519

SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:
1. Underground distribution grounding.
2. Building grounding.
3. IT grounding.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
1. Ground rods.
2. Ground rings.
3. Grounding arrangements and connections for separately derived systems.
4. Grounding for sensitive electronic equipment.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems and telecommunication systems based on NETA MTS.

a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing

Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
1. Stranded Conductors: ASTM B 8.
2. Bonding Conductor: Minimum No. 4 AWG, stranded conductor or as noted on the drawings.
3. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Exposed Cables and Pipes: Copper or copper alloy, bolted pressure- type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Compression Connectors for all Concealed and Underground Cables: Compression kits of types recommended by kit manufacturer for materials being joined and installation conditions. Must comply with IEEE std 837-2002, UL 467 Listed and CSA 22.2 Certified or approved equal by the Engineer.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m in diameter).
1. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install stranded conductors for No. 8 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Compression connectors.
3. Connections to Ground Rods at Test Wells: Compression connectors.
4. Connections to Structural Steel and Poles: Compression connectors.
5. Connections to Structural Rebar: Compression connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Cable tray systems.
9. All IT communications racks.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 12 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

B. Perform the following tests and inspections and prepare test reports:

   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal at individual ground rods. Make tests at ground rods before any conductors are connected.

      a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.

   3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

   4. Panel testing: Perform ground resistance testing between all existing and new panel boards and the main switchboard in the main electrical rooms. Provide test report indicating the resistance for each panel to the main.

C. Report measured ground resistances that exceed the following values:

   1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.

   2. Power and Lighting Equipment or System with Capacity 500 kVA and More: 5 ohms.
   3. Structural Steel / Lightning Protection Grounds: 10 ohms.

D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260528 - AUDIOVISUAL SYSTEMS INFRASTRUCTURE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work of this Section includes labor, materials, equipment and services necessary to complete the provision of audio-visual raceways, cable and related work indicated on the AV drawings and specified in this Section.

B. Contract Work includes, but is not necessarily limited to, the following:

1. Provision of back boxes, floor pockets, blank faceplates, pull boxes, conduit, stub ups.
2. Shop Drawings and samples as required herein.
3. Verification of dimensions and conditions at job site prior to equipment installation and coordination with associated trades.
4. Field coordination at job site.
5. As-Built record drawings.
6. Any additional materials or services needed in order to meet the general requirements stated above, even if not specifically mentioned herein or on the drawings, shall be provided by the Contractor without claim for additional payment.
7. If the drawing and specifications conflict in any regard, the specifications or drawings that illustrates the highest value of material and/or labor shall take precedence.
8. All conduit shall be embedded in concrete walls, above finish ceiling, below grade in exterior areas, ceilings, or floors or above accessible ceilings. No exposed conduit will be permitted. Surface metallic raceway may be used where indicated on drawings, or where concealing conduit in walls is not feasible.

C. Related Work: The following related items are specified in other Sections of the Specifications:

1. General provisions for Electrical work - Applicable sections of Division 26.
2. Information Technology Cable Plant - Section 271000.
3. Electronic Safety and Security – Section 280000.

1.3 QUALITY ASSURANCE

A. Work shall be done by persons skilled in this trade in strict accordance with the requirements and/or specifications of the manufacturers of the material being used.

B. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure steady progress of all work under Contract.

C. All electrical equipment and materials shall have the listing of the Underwriters' Laboratories, Inc., and shall bear the labels attesting to UL listing, and types approved

by the Municipal Departments having jurisdiction.

1.4 REFERENCE STANDARDS

A. Published specifications, standards, tests, or recommended methods of trade, industry or governmental organizations apply to work in all sections as notes below:

1. OSHA - Occupational Safety and Health Administration Regulations.
2. NEMA - National Electrical Manufacturers Association.
3. UL - Underwriters Laboratories.
4. NFPA - National Fire Protection Association.
5. The National Electrical Code.

1.5 DEFINITION OF TERMS

A. The term Electrical Contractor (EC) as used herein refers to the party responsible for supplying all services specified herein and indicated on related drawings.

B. The term Audio-Visual Contractor (AVC) as used herein refers to the party responsible for providing AV equipment, services, supplying and installing the AV cables as described herein and on the drawings. The AVC work is not to be in this contract.

C. Technical terms for audio-visual and related work shall be construed in the following manner, in accordance with:

1. Captions on related drawings.
2. Generally recognized theatrical/public assembly usage.
3. Relevant usage and definitions of handbooks, guidebooks or trade group recommendations by manufacturers' associations or professional and engineering societies such as UL, IES, SMPTE, NEC, NEMA and AVIXA.
4. The term “provide” shall mean supplying and installing.

1.6 JOB CONDITIONS

A. Investigate the nature and location of the Work, the general and local conditions, particularly those bearing upon the Work required such as: transportation, disposal, handling and storage of materials, availability of labor, electric power and physical conditions at the site and character of equipment and facilities needed during the execution of the Work. Obtain all information that can affect the work or cost thereof under the Contract.

1.7 SUBMITTALS

A. Shop drawings and samples shall include the following:

1. Plan, elevation, section as required to fully illustrate all AV, power, telephone, data, fire alarm, switches, outlets, including all system wiring devices indicated on the AV and Electrical drawings including conduit and cable routing (1/4" = 1'-0" min.) between devices indicated on the AV and Electrical drawings.
2. Provide color coded plans of items described above in paragraph 1.
3. The Contractor shall coordinate shop drawings well in advance with other trades. It is the Contractors sole responsibility to obtain all necessary information from other trades.
4. Submit manufacturer’s product data sheet on each floor pocket, ceiling speaker, video projector mount, cable, electrical device and type used in the system.

5. As-Built drawings.

B. The following sample shall be provided to the Architect for review prior to installation:

1. Floor box and specified cover plate of each type.

1.8 PUBLICATION

A. Written approval from the Owner shall be obtained prior to the release of any information concerning this project.

PART 2 PRODUCTS

2.1 DESCRIPTION OF SYSTEMS

A. All raceways and related equipment shall be provided as per applicable sections of Division 26, the Drawings and in accordance with the National Electrical Code and local codes having jurisdiction.

B. All conduit shall be concealed except in areas without a finished ceiling.

C. Surface metallic raceway may be used where indicated on drawings, or where concealing conduit in walls is not feasible.

2.2 GENERAL REQUIREMENTS

A. All materials and components shall be new and of manufacturer's finest quality as appropriate to the application. Uniform materials and components shall be used throughout, and wherever possible, shall be field replaceable and commonly available.

B. All materials shall conform to applicable UL standards and to general electrical requirements unless specifically accepted by requirements of this section.

C. See applicable sections of Division 26 for more information.

2.3 PRODUCTS

A. Pull Boxes

1. Pull boxes shall be in accordance with NEMA/EEMAC Type 1, UL 50 Type 1 and IEC 529, IP30.
2. Box shall be fabricated from 14 gauge steel.
3. Box shall be provided with screw cover plates for flush mounting.
4. Knockouts for conduits shall be as required to meet conduit sizes indicated on plans.
5. Box and screw cover shall be finished with dark gray enamel inside and out.
3. Acceptable Manufacturers:
   a. ASG12X12X6 Type 1 Bulletin A90P1 Screw Cover Pull Boxes by Hoffman Engineering Company
   b. Or Equal.

B. Wall and Ceiling Receptacle Boxes

1. Receptacle boxes, where located on the drawings for AV raceway system, shall be in accordance with NEMA/EEMAC, UL 50 Type 1 and IEC 529, IP30.
2. Boxes shall be fabricated from 16 gauge or 14 gauge steel. All boxes shall be provided with cover plates for flush mounting except where otherwise noted. Knockouts for conduits shall be as required to meet conduit sizes indicated on plans.
3. Ceiling box at video projector locations shall be mounted to the video projector pipe adjacent to the power outlet.
4. Typical device backbox shall be the number of gangs as called for on the Legend, 2- 1/8" deep or as called for on the drawings or legend.
5. Provide knock-out for 1-1/4" EMT conduit stub-up to nearest cable tray or accessible ceiling.
6. Acceptable Manufacturers:
   a. Midland Ross, Leviton, Steel City, Hubbell, or Equal.
   b. See Division 26 of the specifications for additional requirements.

C. Electrical Work Embedded In Concrete

1. Provide suitable PVC rigid conduit, pull boxes for conduit and fitting for conduit paths to be encased in concrete.
2. Penetration of fire rated walls, floors or ceilings shall use classified Through-Penetration Firestop Systems described in the current Underwriters Laboratories Fire Resistance Directory.
3. Fittings, accessories and outlet boxes shall be designed for use with selected conduit. All components shall be listed by Underwriters Laboratories and shall be from one manufacturer.
4. Unless indicated differently on drawings, conduit systems shall be color coded: BLUE for low voltage power, YELLOW for other low voltage communications, For PVC conduit, conduit shall be painted in similar color schedule at each end.

D. Electrical Work Not Embedded in Concrete

1. Provide suitable EMT pull boxes for conduit and fitting for conduit paths not encased in concrete.
2. Penetration of fire rated walls, floors or ceilings shall use classified Through-Penetration Firestop Systems described in the current Underwriters Laboratories Fire Resistance Directory.
3. Fittings, accessories and outlet boxes shall be designed for use with selected conduit. All components shall be listed by Underwriters Laboratories and shall be from one manufacturer.
4. Unless indicated differently on drawings, conduit systems shall be color coded: BLUE for low voltage power, YELLOW for other low voltage communications, for EMT conduit, conduit shall be painted in similar color schedule at each end.

E. Cable Tray

1. Where shown provide cable tray and all required fittings, transition members, junction and butt splice kits, radius bend members, protective end caps, end closing hardware, support brackets and attachment hardware for cable tray where indicated on the drawings.
2. Cable tray shall be UL listed and fabricated from wire mesh shall be nominally 2” high by 12” wide or per width called out on the drawings.
3. Cable tray, support accessories and all hardware components shall be black.

4. Acceptable Manufacturer:
   a. WBT2X12 with Black Finish with WBT Form in custom black finish
   b. Or Approved Equal

F. Video Monitor Back Box

1. Where video monitors are indicated by a JM device, provide a monitor back box to mount power, IT and AV box services within the back box.
2. Box shall have a flange to cover the gypsum wall board cut out for the monitor box.
3. Acceptable Manufacturer:
   a. Chief Manufacturing – PAC525F
   b. Arlington TVB713GC
   c. Or Approved Equal

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine all work prepared by others to receive work of this Section and report any defects affecting installation to the Architect for correction.

B. Commencement of work will be construed as complete acceptance of preparatory work by others.

C. All devices shall be installed as per applicable sections of Division 26 and in accordance with the National Electric Code.

3.2 GENERAL REQUIREMENTS

A. Contract Drawings are diagrammatic and indicate general arrangement of systems and work included. Verify exact location of all electrical devices with architectural drawings. If a dimension is not indicated on either the architectural or AV drawings, request in writing, required information prior to proceeding. Any work installed without written direction that is not specifically indicated on the drawings may be rejected and relocated at Contractor expense. All finish or other work by others damaged by relocation of any electrical device shall be the responsibility of the Contractor.

B. Final location of all equipment shall be located as shown on Contractor's reviewed Shop Drawings, or as located in the field by the Architect, or as shown on supplementary drawings prepared by the Consultant. Check drawings of other trades relating to work to verify spaces in which work will be installed. In centering outlets and locating boxes allow for overhead pipes, ducts and mechanical equipment, variations in fireproofing and plastering, window and door trim, paneling, hung ceilings, and the like, and correct any inaccuracy resulting from failure to do so without expense to Owner.

3.3 RACEWAYS

A. General Requirements

1. No exposed raceways shall be permitted, unless otherwise noted.
2. Pull no wire; insert no fish wire, until raceway and outlet boxes are permanently in place.

3. Provide cable supports for wire in riser conduits as required by code, if applicable.
4. Provide pull boxes in horizontal conduit running every 100 feet as indicated or wherever necessary to facilitate pulling in of wire. Coordinate locations with other trades to provide access.
5. All conduit penetrations through acoustically rated partitions shall be a maximum

   of 1/2" larger than the penetrating conduit and shall be thoroughly caulked with acoustical non-setting caulk.
6. Provide drag lines with conduit destination noted on drag line to facilitate pulling of cable.
7. No MC or greenfield shall be permitted for AV conduit.

B. Raceway Grounding & Isolation

1. Signal conduits shall be mechanically and electrically connected to receptacle boxes and shall be electrically isolated from audio-visual system equipment racks.
2. Provide terminals of conduits with lock nut and insulated bushing for connection to pull boxes servicing more than one conduit subsystem as described in the separation Guide Identification table below.

C. Separation of Signal Raceways

1. Microphone level circuits, line level circuits, loudspeaker circuits, video, digital communication lines (including lighting control) and telephone lines shall be run in separate conduits. All conduits shall be installed per the table below. If not physically possible to provide the separation specified for parallel runs over 25', the exterior of the signal conduit with the lowest voltage shall be completely wrapped in 1/32" thick lead sheet. Where it is absolutely necessary to cross a conduit with a conduit where separation is called for, the intersection shall be at 90 degrees and the audio conduit shall be wrapped in 1/32" lead sheet for a distance of 12" each side of the intersection.
2. The following table shall be used as a guide for the minimum separation required between signal conduits.

   a. Group Identification
      a) Microphone conduit (0mV-100mV)
      b) Line level conduit (100mV-10V)
      c) Loudspeaker conduit (10V-70.7V)
      d) Telephone, Video and digital communication conduit

Group	a	b	c	d
a	-	6"	12"	12"
b	6"	-	12"	6"
c	12"	12"	-	6"
d	12"	6"	6"	-

   b. Group Identification
      e) Dimmer controlled lighting circuits
      f) Power circuits (120V and above)
      g) Plumbing Pipe
      h) Heat Sources

Group	e	f	g	h
A	24"	12"	6"	12"
B	24"	12"	6”	12”
C	12	12"	6”	6"
D	12"	12"	6"	6”

3.5 WORKMANSHIP

A. The installation of all work shall be neat. All boxes, equipment, etc., shall be plumb and square.

B. Following installation, all soiled, abraded or discolored surfaces of work installed herein will be cleaned and left free from blemishes or defects.

C. Work that is damaged or improperly installed will be removed and replaced and the entire installation left in complete satisfactory condition.

D. Any damage brought about by Contractor's work shall be repaired by the Contractor at no cost to the Owner.

END OF SECTION 260528

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit (galvanized).

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Galvanized Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded

body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

3. Concrete Inserts: Stainless Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway (including trapeze type systems): Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter. Exception:

1. Where attached to wood framing systems in the building, the support spacing shall be double the requirements scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70.
2. The intent of this exception is to distribute the loading of the raceways on the wood framing system.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with galvanized steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1- 1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices

on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, floor boxes, handholes, overfloor raceway and cabinets for electrical wiring.

B. Refer to Section “Low-Voltage Electrical Power Conductors and Cables” for allowable applications of conduit/raceway vs. MC Cable.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. FMC: Flexible metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. LFNC: Liquidtight flexible nonmetallic conduit.

F. RMC or GRS: Galvanized rigid metal conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.
2. For handholes and boxes for underground wiring, including the following:

    a. Duct entry provisions, including locations and duct sizes.
    b. Frame and cover design.
    c. Grounding details.
    d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
    e. Joint details.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Maverick Tube Corporation.
5. O-Z Gedney; a unit of General Signal.
6. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1 with threaded fittings.

C. IMC: ANSI C80.6.

D. EMT: ANSI C80.3, with compression fittings.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1. Fittings for EMT: Die-cast, compression type.
2. Fittings for RGS: Threaded type.

G. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. CANTEX Inc.
3. CertainTeed Corp.; Pipe & Plastics Group.
4. Condux International, Inc.
5. ElecSYS, Inc.
6. Electri-Flex Co.
7. Lamson & Sessions; Carlon Electrical Products.
8. Manhattan/CDT/Cole-Flex.
9. RACO; a Hubbell Company.
10. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type PVC Schedule 40, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Spring City Electrical Manufacturing Company.
9. Thomas & Betts Corporation.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

H. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.4 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with the latest revision / edition of ANSI/SCTE 77.

1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC" or “COMMUNICATIONS”.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 12 inches long and larger shall have inserts for cable racks and pulling-in irons installed.
8. Listings: UL listed.
9. Ratings: ANSI/SCTE 77 Tier 22.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. CDR Systems Corporation.
d. NewBasis.
e. Quazite.

2.5 FLOOR BOXES

A. Manufacturers:
1. Hubbell Wiring Devices
2. Legrand Wiremold
3. Approved equal by the Engineer.

B. Floor Boxes
1. Refer to the contract drawings for selected floor box types and sizes.
2. For each floor box, the contractor is required to coordinate:
a. The floor slab thickness.

b. Floor material type, so the proper floor box cover can be ordered.
c. Devices in each box.
d. Faceplates for each device type.
e. Furniture feed coordination.
f. Coordinate with Owner's A/V vendor.
g. Dividers as required to separate 600V and low-voltage wiring.

2.6 AV BACKBOXES

A. Refer to drawing EG.1 symbol list for specific backbox requirements for AV equipment.

2.7 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoor: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: Rigid steel conduit.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried or concrete encased ductbank as indicated on the drawings.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X.
6. Application of Handholes and Boxes for Underground Wiring:
   a. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Deliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 22 structural load rating.
   b. Route conductors and cables around (service loop) the handhole prior to exiting.

B. Indoor: Comply with the following indoor applications, unless otherwise indicated; refer also to Section "Low-Voltage Electrical Power Conductors and Cables":
1. For allowable indoor raceways and MC Cable, refer to Section 260519.
2. Indoor conduit for all areas: EMT.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
4. Damp or Wet Locations or in Kitchens: Rigid steel conduit.
5. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4X, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. Electrical Metallic Tubing: Use die-cast compression fittings.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

K. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic, as follows:
1. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

M. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving", except provide a minimum of 3" of silt stone surrounding conduit prior to backfill, except where indicated to be concrete encased.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Tape: Bury detectable warning tape approximately 12 inches (300 mm) above direct-buried conduits.

7. For all underground conduits entering the building, provide Raychem Rayflate kits for the conduit interiors to prevent water ingress to the building.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.7 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

B. Requirements of the following Division 26 Sections apply to this Section:

1. "Basic Electrical Requirements."
2. "Basic Electrical Materials and Methods."

1.2 SUMMARY

A. This section includes underground electrical work including the following:

1. PVC ducts.
2. Steel ducts.
3. Duct banks.
4. Manholes.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 31 Section "Earth Moving" for general requirements for excavation, backfill and related items for ducts and manholes.
2. Division 03 Section "Cast-in-Place Concrete" for cast-in-place concrete requirements.

1.3 DEFINITIONS

A. Duct: The general term for electrical conduit and other raceway, either metallic or nonmetallic, specified for use underground, embedded in earth or concrete.

B. Duct Bank: A group of two or more ducts in a continuous run between two points.

C. Manhole: A below-the-surface enclosure or chamber, large enough for a person to enter, connecting with ducts, and affording facilities for installing, operating, and maintaining equipment or wiring.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. The shop drawing for manholes and ductbank housing the incoming service from the Utility Co. shall be approved by the Utility Co. prior to manufacturing and installation of the above.

C. Product data for metal accessories for manholes and raceway, duct, duct bank materials, and

miscellaneous components. Include:

1. Frames and covers.
2. Pulling eye assemblies.
3. Pulling and lifting hardware.
4. Bolting inserts.
5. Cable stanchions, arms, and insulators.
6. Sump frames and cover.
7. Raceways and fittings.
8. Raceway supports.
9. Manhole ladder.

D. Shop Drawings: Detail drawings and design calculations for precast manholes including reinforcing steel. Drawings shall bear the stamp of a registered professional structural engineer.

E. Coordination drawings showing duct profiles and coordination with other utilities and underground structures.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturers of precast manholes shall be firms regularly engaged in manufacturing factory-fabricated manholes, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete units at site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.7 SEQUENCING AND SCHEDULING

A. Coordination of the Work: Coordinate layout and installation of manholes with final arrangement of ducts as influenced by actual final location of other utilities in the field. Coordinate elevations of duct and raceway entrances into manholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and assure duct runs drain to manholes and as approved by the Architect.

1.8 EXTRA MATERIALS

A. Furnish the following extra materials matching products installed, packaged with protective covering for storage and with identification labels clearly describing contents.

1. Cable stanchions, support arms, insulators, and associated fasteners in the quantity of 10 percent of those installed for actual use in this project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Precast Manholes:

a. AC Miller Co.
b. Christy Concrete Products, Inc.
c. Elmhurst-Chicago Stone Co.
d. Rotondo/Penn-Cast, Inc.
e. Smith-Midland Corp.
f. Utility Vault Co.
g. Wausau Concrete Co.

2. Frames and Covers:

a. East Jordan Iron Works, Inc.
b. Campbell Foundry Co.
c. McKinley Iron Works.
d. Neenah Foundry Co.

3. Nonmetallic Ducts:

a. Anamet, Inc.
b. Arnco Corp.
c. Breeze-Illinois, Inc.
d. Carlon.
e. Certainteed Products Corp.
f. Cole-Flex Corp.
g. Condux International.
h. Electri-Flex Co.
i. R&G Sloan Mfg. Co., Inc.
j. Spiraduct, Inc.

2.2 DETECTABLE TAPE

A. Provide detectable tape above all underground duct runs for future verification of duct and cable locations. Submit cuts to the Engineer for approval.

2.3 DUCTS AND FITTINGS

A. General: Ducts and duct fittings and accessories for which listing has been obtained by one or more manufacturers shall be UL listed and labeled.

B. General: Ducts and duct fittings and accessories for which listing has been obtained by one or more manufacturers shall be listed and labeled by a Nationally Recognized Testing Laboratory (NRTL). The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

C. Galvanized Rigid Steel Conduit: ANSI C80.1.

D. PVC Externally Coated Rigid Steel Conduit and Fittings: ANSI C80.1 and NEMA RN 1.

E. Rigid Nonmetallic Conduit (RNC): NEMA TC 1 and UL 651, Schedule 40 or 80, PVC, rated for use with 90 deg C conductors under all installation conditions.

F. PVC Conduit and Tubing Fittings: NEMA TC 3; match to conduit type and material.

G. PVC and ABS Plastic Utilities Duct: NEMA TC 6, Type EB for encased burial in concrete, Type DB for direct burial.

H. Extra Strength PVC Plastic Utilities Duct: NEMA TC 8, Type EB for concrete encasement, Type DB for direct burial.

I. PVC and ABS Plastic Utilities Duct Fittings: NEMA TC 9; match to duct type and material.

J. Manufactured Bends: Not less than 36-inch radius.

2.4 CAST-IN-PLACE CONCRETE

A. Conform to Division 03 Section "Cast-in-Place Concrete" for concrete and reinforcing.

B. Aggregate For Duct Encasement: 3/8-inch maximum size.

C. Strength: 3000 psi minimum 28-day compressive strength.

2.5 PRECAST MANHOLES

A. Work Included

1. The work under this Section shall consist of the purchase and installation of precast manholes shown on the contract drawings.
2. Provide all labor, materials, equipment and services necessary to perform the work of this Section.

B. The pre-cast manholes shall be A.C. Miller or approved equal. The manholes shall be designed for an AASHTO HS20 Live Load and appropriate dead load. Portland cement shall conform to ASTM C-150, Type 1. The minimum strength required in 5000 psi aggregates shall conform as outlined to ASTM A-615 Grade 60. All wire welded fabric shall conform to ASTM A185. The uniformly sized and graded aggregates, cement, water and admixtures shall be accurately proportioned and thoroughly mixed to produce a concrete mixture of such quality so that the manhole shall conform to the test and design requirements. Knockout panels of suitable dimensions shall be provided in the manhole walls where duct lines enter the manholes as shown on the plans. Floors shall be sloped for drainage towards the sump recess. Pulling irons shall be provided in the manhole wall opposite each wall opening on the center line of the

opening, a minimum of six inches (6") above the floor.

C. The manufacturer shall submit for approval showing details of construction of the Pre-Cast Manhole, including amount and placement of the reinforcing steel. Accurate records of the compression tests and core samples shall be maintained by the manufacturer and shall be made available to the Engineer. If the Contractor desires to substitute a specific manufacturer's manhole other than specified herein, he shall submit complete information concerning the proposed substitution. No substitutions shall be made without the approval of the Engineer.

D. Manhole Frames and Covers: Provide standard type frames and covers unless noted otherwise. Provide ELECTRIC emblem for covers, unless otherwise required by the utility.

E. Waterproofing shall be submitted for approval.

2.6 RACEWAY/DUCT SEALING COMPOUND

A. Compound: Nonhardening, putty-like consistency workable at temperatures as low as 35 deg F. Compound shall not slump at a temperature of 300 deg F and shall readily adhere to clean surfaces of plastic ducts, metallic conduits conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and the common metals. Compound shall have no injurious effect on worker's hands or materials.

2.7 MANHOLES - MISCELLANEOUS

A. The Contractor shall provide an excavation of suitable dimensions to set the manhole. The floor of the excavation shall be level and shall have a three inch (3") sand bed to receive the manhole.

B. The Contractor shall set the frame and cover at the proper elevation. The Contractor shall provide the eight inch (8") high ring/chimney as shown on the plans. The Contractor will be responsible to make proper duct connections.

C. New manholes: 3/4" diameter x 10 foot ground rod shall be provided for future connection for cable shields. Contractor shall allow sufficient slack in cable shield for future connection to this ground rod.

D. Cable in the manholes shall be supported by rack type supports. The supports shall consist of a hot-dip galvanized steel tee carrying one or more hot-dipped galvanized malleable iron cable hooks, for a number of cables as required, with white glaze porcelain insulators for the support of cables. Cable rack hooks shall have a stop to keep the insulators from sliding off. The racks shall be arranged for vertical mounting and shall be securely bolted in place with 5/8 inch x 4- 1/2 inch hex head galvanized bolts secured with "cinch" anchors. The rack supports shall be used to support horizontal runs only. The maximum spacing shall be thirty inches.

2.8 DUCT BANK ACCESSORIES

A. Duct Supports: Rigid PVC spacers selected to provide minimum duct spacings and concrete cover depths indicated, while rigidly supporting ducts during concreting.

2.9 MANHOLE HARDWARE AND ACCESSORIES

A. Frames and Covers: Cast iron conforming to ANSI C2, "National Electrical Safety Code," Rule 323. Furnish with cast-in legend, "Electric" or "Signal" as appropriate. Cover-to-frame bearing surfaces machined.

B. Sump Frame and Grate: Comply with FS RR-F-621, Type VII for frame, Type I for cover.

C. Pulling Eyes in Walls: Eyebolt with rebar fastening insert. 2-inch diameter eye, 1-inch- by 4- inch-long bolt. Working load embedded in 6-inch, 4000 psi concrete: 13,000 pounds minimum tension.

D. Pulling and Lifting Irons in Floor: 7/8-inch-diameter hot-dipped galvanized, bent steel rod, stress relieved after forming, and fastened to reinforced rod. Exposed triangular shaped opening. Ultimate yield strength, 40,000 pounds shear, 60,000 pounds tension.

E. Bolting Inserts for Cable Stanchions: Flared, threaded inserts of noncorrosive, chemical resistant, nonconductive thermoplastic material. 1/2-inch internal diameter by 2-3/4 inches deep, flared to 1-1/4-inch minimum at base. Tested ultimate pull-out strength: 12,000 pounds, minimum.

F. Expansion Anchors for Installation After Concrete is Cast: Zinc-plated carbon steel wedge type with stainless steel expander clip 1/2-inch bolt size, 5,300-pound rated pull-out strength, and 6,800-pound rated shear strength, minimum.

G. Cable Stanchions: Hot-rolled, hot-dipped galvanized "T" section steel, 2-1/4-inch size, punched with 14 holes on 1-1/2-inch centers for cable arm attachment.

H. Cable Arms: 3/16-gage hot-rolled, hot-dipped galvanized sheet steel pressed to channel shape, approximately two 12 inches wide by 14 inches long and arranged for secure mounting in horizontal position at any position on cable stanchions.

I. Cable Support Insulators: High glaze, wet process porcelain arranged for mounting on cable arms.

J. Ground Rods: Solid copper clad steel, 3/4-inch diameter by 10-ft. length. Provide one in each manhole and bond all metal in the manhole to the ground rod.

K. Ground Wire: Stranded bare copper, No. 4 AWG, minimum.

PART 3 - EXECUTION

3.1 WIRING METHOD

A. General: Install ducts for wiring runs indicated. Provide sizes as indicated.

B. Single and Multiple Duct Runs for 15kV cabling: PVC schedule 40 conduit, encased in a minimum of 3” of concrete on all sides, with a #4/0 grounding conductor run within 2” of the top of the ductbank.

3.2 EXCAVATION AND BACKFILL

A. Excavation and Backfill: Conform to Division 31 Section "Earth Moving," except heavy-duty, hydraulic-operated compaction equipment shall not be used and trenching for ducts shall conform to the following:

1. Excavation: Cut trenches neatly and uniformly, and slope uniformly to required pitch.
2. For direct-buried, non-encased ducts prepare trench bottoms free from stones, soft spots, and sharp objects. Where necessary, add a 3-inch layer of stone-free sand or earth to trench bottom and compact to density of adjacent undisturbed soil to provide suitable bearing for ducts. Backfill over and around ducts on bottom of trench with stone-free sand or earth to 6 inches minimum above tops of ducts and compact by hand or pneumatic tamper to density of adjacent undisturbed earth.
3. For each additional layer of direct-buried ducts above bottom ducts, backfill over and around each layer of ducts with stone-free sand or earth to 6 inches minimum above tops of ducts and compact by hand or pneumatically to density of adjacent undisturbed earth.
4. Separation Between Direct-Buried, Non-encased Ducts: Three inches minimum for like services, and 12 inches minimum between power and signal ducts.

3.3 INSTALLATION OF DUCTS

A. Slope: Pitch ducts to drain towards manholes and away from buildings and equipment. Minimum slope shall be 4 inches in 100 ft. Where necessary to achieve this between manholes, slope ducts from a high point in the run to drain in both directions. Drive stakes in the bottom of the trench at 6 ft. intervals maximum, and use to establish slope.

B. Curves and Bends: Use manufactured elbows for stub-ups at equipment and at building entrances. For all other curves and bends, except as otherwise indicated, use manufactured long sweep bends with a minimum radius of 25 ft. in both horizontal and vertical directions.

C. Joints in ducts and fittings shall be made up watertight in accordance with manufacturer's instructions. Couplings shall be staggered so those of adjacent ducts do not lie in the same plane.

D. Duct Entrances to Manholes: End bells spaced approximately 10 inches center to center for 5-inch ducts and varied proportionately for other duct sizes. The change from regular spacing to end bell spacing shall start 10 ft. from the end bell and shall be made without reducing duct line slope and without forming a trap in the line. Grout end bells into manhole walls from both sides to provide watertight entrances.

E. Duct Entrances to Buildings: PVC conduit. Install in accordance with the following:

1. Concrete-Encased Ducts: Install reinforcing in duct banks through disturbed earth near buildings and excavations and coordinate duct bank with structural design at wall so duct bank is supported at wall without reducing structural or watertight integrity.
2. Refer to Section 260533 for Link-Seal type conduit seals for each conduit entrance to the building.
3. Provide Raychem Rayflate kits for each conduit entry to the building for sealing.

F. Concrete-Encased Nonmetallic Ducts: Support on plastic separators coordinated with duct size and required duct spacing, and install in accordance with the following:

1. Separator Installation: Space separators close enough to prevent sagging and deforming

of ducts, and secure separators to the earth and to ducts to prevent floating during concreting. Do not use tie wires or reinforcing steel in such a way as to form conductive or magnetic loops around ducts or duct groups.

2. Concreting: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not use power-driven agitating equipment unless specifically designed for duct bank application. Pour each run of envelope between manholes or other terminations in one continuous operation. Where more than one pour is necessary, terminate each pour in a vertical plane and install 3/4- inch reinforcing rod dowels extending 18 inches into the concrete on each side of the joint near the corners of the envelope.
3. Reinforcing: Reinforced duct banks where they cross disturbed earth and where indicated. Size and arrangement of reinforcing steel as indicated.
4. Forms: The walls of the trench may be used to form the side walls of the duct bank provided the soil is self-supporting and concrete envelope can be poured without soil inclusions. Use forms where the soil is not self-supporting.
5. Minimum Clearances Between Ducts: Three inches between ducts and exterior envelope wall, 3 inches between ducts for like services, and 12 inches between power and signal/communication ducts.
6. Depth: Except as otherwise indicated, top of duct bank shall be 24 inches below finished grade, minimum, in nontraffic areas, and 30 inches below finished grade, minimum, in vehicular traffic areas.

G. Stub-ups: Duct stub-ups to equipment shall be galvanized rigid steel. For equipment mounted on outdoor concrete pads, steel conduit shall extend a minimum of 5 ft. away from edge of pad. Install insulated grounding bushings on the terminations. The steel conduits shall be coupled to the ducts with adapters designed for the purpose and the whole encased with 3 inches of concrete.

H. Sealing: For ducts to be wired in this project, provide temporary closure at terminations. For spare ducts, seal bore of ducts at terminations. Use sealing compound and plugs as required to withstand 15 psi minimum hydrostatic pressure.

I. Pulling Cord: Install heavy-duty nylon pulling cord in ducts including spares.

3.4 INSTALLATION OF MANHOLES, GENERAL

A. General: Provide manholes of sizes, shapes, and locations as indicated. Determine final grading of ducts as influenced by possible adjustments in other utilities and surface features and discovery of underground obstructions before installing manholes. Obtain Architect's approval for manhole installation adjustments necessitated by the above. Install units plumb and level and with orientation and depth coordinated with arrangement of connecting ducts to minimize bends and deflections required for proper entrances.

B. Elevation: Install manholes with roof top 15 inches below finished grade, minimum.

C. Drainage: Install drains in bottom of units where indicated. Arrange to coordinate with drainage provisions indicated or specified.

D. Access: Install access to manhole through cast-iron frame and cover. For manholes, use 30-inch cover except as indicated. Install brick chimney to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof

grouting of cast iron frame to chimney. Set frames in paved areas and traffic ways flush with finished grade. Set other frames 1 inch above finished grade.

E. Hardware: Install removable hardware including pulling eyes, cable stanchions, cable arms, and insulators as required for installation and support of cable and conductors and as indicated.

F. Field-Installed Bolting Anchors: Do not drill deeper than 3-7/8 inches for anchor bolts installed in the field. Use a minimum of 2 anchors for each cable stanchion.

G. Grounding: Install ¾" x 10' copper ground rod through floor of each manhole with top protruding 4 inches above floor. Seal the floor opening against water penetration with waterproof nonshrink grout. Ground exposed metal components and hardware with bare copper ground conductor. Train conductors neatly around corners. Install on walls and roof using cable clamps secured with expansion anchors.

3.5 INSTALLATION OF PRECAST MANHOLES

A. Install in accordance with ASTM C 891, "Practice for Installation of Underground Precast Concrete Utility Structures," and manufacturer's instructions.

B. Support units on a level bed of crushed stone or gravel, graded from the 1-inch sieve to the No. 4 sieve and compacted to same density as adjacent undisturbed earth.

3.6 FIELD TESTING

A. Grounding: Test manhole grounding provisions to ensure electrical continuity of bonding and grounding connections. Make ground- resistance test at each ground rod and submit a report of the results. Use an instrument specifically designed for ground-resistance measurements.

B. Duct Integrity: Rod ducts with a mandrell 1/4-inch smaller in diameter than internal diameter of ducts. Where rodding indicates obstructions in ducts, remove the obstructions and retest.

C. Water Tightness: Make internal inspection of manholes three months after completion of construction for indications of water ingress. Where leakage is noted, remove any water found and seal leakage sources. Reinspect after two months and reseal any remaining leakage sources. Repeat process at two month intervals until leakage is corrected.

3.7 CLEANING AND RESTORATION.

A. Clean Ducts: Clean full length of ducts with a round bristle brush with a diameter 1/2 inch greater than internal diameter of duct.

B. Clean Manholes: Clean all internal surfaces of manholes including sump. Remove all foreign material.

C. Restore surface features at areas disturbed by excavation and reestablish original grades except as otherwise indicated. Restore disturbed paving as indicated.

END OF SECTION 260543

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Identification for raceway and metal-clad cable.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.
8. Self-adhesive labels for all switches and receptacles.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power Circuits: Black letters on an orange field.
2. Emergency Circuits: Black letters on a red field.
3. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core (detectable).
4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Warning label and sign shall include, but are not limited to, the following legends:
1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

E. Multiple Services: Label multiple services in the same building indicating the location of the other service and the purpose of the service.

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.6 kg), minimum.
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service and Feeders: Identify with orange self-adhesive vinyl label.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands or snap-around, color-coding bands:

1. Fire Alarm System: Red.
2. Fire-Suppression Supervisory and Control System: Red and yellow.
3. Combined Fire Alarm and Security System: Red and blue.
4. Security System: Blue and yellow.
5. Mechanical and Electrical Supervisory System: Green and blue.
6. Telecommunication System: Green and yellow.
7. Control Wiring: Green and red.

C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape and aluminum wraparound marker labels. Identify source and circuit number of each set of conductors. For all conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. For all conditions (more than one conductor in a box), identify each ungrounded conductor according to source and circuit number.

E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

I. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures, including panel source and circuit number.
b. Access doors and panels for concealed electrical items.
c. Electrical switchgear and switchboards, including panel source and circuit number.
d. Transformers, including panel source and circuit number.
e. Electrical substations.
f. Emergency system boxes and enclosures.
g. Motor-control centers.
h. Disconnect switches, including panel source and circuit number.
i. Enclosed circuit breakers, including panel source and circuit number.
j. Motor starters and drives, including panel source and circuit number.
k. Push-button stations.
l. Power transfer equipment.
m. Contactors.
n. Remote-controlled switches, dimmer modules, and control devices, including panel source and circuit number.
o. Battery inverter units.
p. Battery racks.
q. Power-generating units.
r. Voice and data cable terminal equipment.
s. Master clock and program equipment.
t. Intercommunication and call system master and staff stations.
u. Television/audio components, racks, and controls.
v. Fire-alarm control panel and annunciators, including panel source and circuit number
w. Fire alarm initiation and notification devices shall have a clear, self-adhesive label applied that contains minimum 10 pt black lettering indicating the SLC or NAC panel loop number and address or number of the device.
x. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.

y. CCTV systems.
z. Monitoring and control equipment.

aa. Uninterruptible power supply equipment.
bb. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
cc. Junction boxes with panel source and circuit number(s).
dd. Receptacles and switches, including panel source and circuit number. Minimum 10 pt font. See 3.2.K below for additional requirements.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50- foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

a. Phase A: Brown.
b. Phase B: Orange.
c. Phase C: Yellow.

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below

finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

K. For all Receptacles and switches, provide the following labeling: Provide clear, self adhesive label on all faceplates with 10 pt black lettering identifying the panel source and circuit number.

L. For all architectural/food service, mechanical, plumbing and fire protection equipment, provide the following labeling:
1. Indoor: Provide clear, self adhesive label with minimum 10 pt black lettering identifying the panel source and circuit number.
2. Outdoor: Provide engraved label with minimum 14 pt black lettering identifying the panel source and circuit number.

END OF SECTION 260553

SECTION 260923 - DIGITAL NETWORK LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Installed system shall be comprised of stand-alone and networked control devices as indicated. System control devices shall include, but are not limited to:

1. Digital Room Controllers
2. UL924 Load Controller
3. Fixture Control Modules
4. Lighting Control Panels
5. Sensors
6. Wall Stations
7. Network Area Controller
8. Network Modules
9. Network Accessories
10. Software Interfaces
11. Conductors and Cabling

1.2 SYSTEM DESCRIPTION

A. The contractor shall provide and install Distributed Intelligence Lighting Control System as shown on plans and specified herein. Distributed Intelligence Lighting Control System shall be designed and configured to send and receive control, monitoring, operating and maintenance signals and commands wired and or wirelessly to and from networked enabled room controllers, fixture modules, switch stations, occupancy and daylight sensors, lighting control panels and other controls devices.

1.3 SUBMITTALS

A. Prior to fabrication and shipment of lighting control components, manufacturer shall provide submittal documentation for approval.

B. Submittal documentation shall include:

1. Bill of Material including a list of components to be supplied,
2. Device specification sheets indicating device features, certifications, dimensions, construction specifications, electrical specifications, wiring diagrams, nomenclature, and related products,
3. Component schedules: Indicating lighting control device types and locations
4. Lighting panel schedules,
5. Wiring diagrams,
6. Control cable type and routing requirements,
7. System riser drawings of sufficient detail to indicate relative placement of major system components and the required connections between each,
8. Contractor Startup Request Form – to be completed prior to factory startup,
9. Operating and maintenance instructions, manuals and/or videos.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualification: Manufacturer of lighting control devices with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system.

1. Approval of Comparable Products: Submit the following at least 10 days prior to submission of a proposal package. Substitution submitted without the below shall be rejected.
   a. Submit line-by-line comparison that describes differences, if any, between each lighting control device specified and those being proposed. Comparison shall include differences in size, quantity, quality, method of control, features and functions, control software functions, and installation requirements.
   b. Product data, including certified independent test data indicating compliance with requirements.
   c. Samples of each component.
   d. Project references: Minimum of 3 installations not less than 3 years old, with Owner and Architect contact information.
   e. Sample warranty.
2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.

B. Factory Assembly: All system components shall arrive at the job site completely pre-wired and ready for installation, requiring only the connection of lighting circuits and network terminations. All connections shall be made to clearly and permanently labeled termination points or by connectorized cable. Systems that required field assembly shall not be acceptable.

C. Component Testing: All system components and assemblies shall be individually tested prior to assembly. Once assembled, all finished products shall be tested for proper operation of all control functions per specifications prior to shipment.

1.5 SYSTEM COMPLIANCE

A. Compliance: Where indicated, individual components shall comply with the following requirements:

1. NEC Compliance: All system components shall comply with all applicable sections of the National Electrical Code (NEC) NFPA 70 as required.
2. NEMA Compliance: All system components shall comply with all applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
3. UL Approval: All applicable equipment shall be tested to and listed under UL standard 508, UL standard 916 or UL924 and shall bare labels to indicate compliance. Lighting control relays shall be tested to UL standard 508 for both safety and endurance. Systems listed under ETL or other UL sections shall provide documentation proving compliance with UL standards as listed above.
4. FCC Emissions: All applicable equipment shall comply with FCC emissions standards specified in Part 15, sub-part j for commercial and residential applications and shall bear labels indicating compliance testing. Equipment that does not meet these standards shall not be acceptable.

1.6 WARRANTY

A. Manufacturer shall warrant the lighting control system components to be free from defects in material and workmanship for a period of five (5) years from the date of the certificate of building occupancy or proof of installation, whichever occurs first (“Warranty Period”). If the certificate of building occupancy is not available or there is no proof of installation, the Warranty Period shall begin with the Product ship date.

B. Manufacturer’s warranty shall include the repair or replacement product(s) with the same or a functionally equivalent product(s) or component part(s).

C. Manufacturer shall provide telephone technical support and remote diagnostics where applicable during normal business hours excluding manufacturer holidays.

D. Upon request, Manufacturer shall provide quotation for manufacturer service contract option(s) which include on-site technician visits for service and repair.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers
1. Current

B. Basis-of-Design: NX Lighting Controls System manufactured by HLI Solutions, a division of Current, Greenville SC.

2.2 SYSTEM ARCHITECTURE

A. System shall consist of wired and/or wireless, distributed intelligent lighting control devices consisting of but not limited to control modules with ON/OFF, full range dimming and CCT control capabilities, and system input devices including but not limited to occupancy/vacancy sensors, daylight sensors and manual switch stations.

B. System shall provide for automatic self-configuration of system devices. Self-configuration shall be accomplished by the devices themselves and provide for control of lighting prior to system custom configuration and programming. Systems that require configuration prior to use shall be considered unacceptable.

C. To implement lighting control strategies, the system architecture shall facilitate the association of system input devices to control modules. The system shall use the Area/Zone/Group assignment strategy. The system shall support up to 128 Areas. Each area shall consist of up to 128 Zones and each zone shall consist of up to 16 Groups. Each device may be programmed to participate in one Area and Zone however may belong to one or more of the available 16 Groups within a Zone.

D. System shall provide time-of-day and astronomical clock scheduling. Each Area/Zone shall support up to 99 scheduled events for use in developing time-of-day or astronomical clock sunrise/sunset automated schedules. Each schedule shall have the ability to turn a group ON or OFF or activate a preset lighting scene at a scheduled time. Schedules shall be day-of-week

selectable and may be programmed to activate on any combination of days of the week (Sunday through Saturday) or to activate on a specific date/holiday.

E. System shall support blink alerts. Relay outputs within the control modules shall be programmable to blink prior to being turned OFF. Blink alert duration time shall be adjustable. Control modules programmed for the blink alert function shall blink the controlled lighting prior to turning OFF to warn occupants of the upcoming OFF event. If an ON command is received during the blink alert time, relay output will be overridden and left ON for the override time. Override time shall be adjustable.

F. System input devices shall be deployed in a space to monitor and broadcast changes such as occupancy, daylight levels and manual switch input.

G. System customization and programming shall be performed from a mobile App and/or web-based configuration and system management tools.

H. System shall have an intuitive and easy to use Graphical User Interface (GUI) to configure, control, monitor and schedule individual devices or groups of devices.

I. System shall remain fully functional during the programming process. Lighting control systems that must be taken “OFFLINE” for programming are not acceptable. All programming changes shall take effect immediately as they are programmed.

J. System shall be capable of being accessed from a local network or remotely using any standard Internet browser. System shall not require any special client-side software. Systems which utilize special client-side software shall not be acceptable.

K. Systems devices shall be capable of communication with each over one or all of the below methods.

1. RS485 multidrop serial network
2. Wireless mesh network
3. Ethernet TCIP network

L. Wired – RS485/Ethernet

1. System shall provide an Ethernet communication backbone (HubbNET™) for the connection of control Zones.
2. System shall utilize the RS485 standard for connection of and communications between Zone Devices.
3. System shall utilize the RS485 standard for connection of and communications between SmartPORT™ devices (e.g., Sensors, Switches and Accessories) connected within a NX Zone.

M. Wireless – Coordinator-less, Self-Organizing/Self-Healing Mesh

1. System shall have a wireless architecture that utilizes the Synapse Network Appliance Protocol (SNAP) to create a peer-to-peer, self-organizing and self-healing mesh network infrastructure.
2. System shall have no single point of failure. A master controller/coordinator or master node shall not be required for proper system operation. All nodes shall be capable of communicating with each other without the need of these types of single point of failure devices. Systems which utilize a master controller/coordinator shall not be acceptable.

3. System shall be self-organizing. The mesh network of devices shall self-organize automatically without the need to manually set device addresses via dials, DIP switches or other means.
4. System shall be self-healing. System devices within the mesh network shall automatically reroute messages around a failed device to ensure messagedelivery.
5. System architecture shall facilitate data transmission between wireless devices over the 2.4GHz ISM radio frequency (RF) band with a supported RF range of 100ft between wireless devices indoors and 300ft outdoors.
6. System shall use the SNAP communication protocol to transmit/receive and negotiate messaging among wireless devices.
7. System shall utilize spread spectrum frequency hopping to facilitate robust communication and prevent the unauthorized interception of messages over the air and to comply with FCC requirements.
8. System shall provide the ability to secure messages. When implemented, each device shall use the strong and secure AES-128 (Advanced Encryption Standard) security cipher to encrypt and decrypt messages. System shall also use the secure HTTPS/SSL protocol when users access the system using their Internet browser.

N. System devices shall be capable of having their firmware updated or upgraded over the air through the wireless mesh network.

2.3 DIGITAL ROOM CONTROLLERS

A. NX Room Controllers

1. Basis of Design Product: Hubbell Control Solutions, NX Room Controllers.
2. As indicated and where shown on the plans, install Hubbell Control Solutions NXRC series Room Controller(s) to control the quantity of lighting and plug loads required.
3. NX Room Controller(s) shall integrate the functionality of connected control components including wall switch stations, occupancy sensors and daylight sensors to provide the required sequence of operation for the space.
4. NX Room Controller(s) and associated room control components shall operate in a totally standalone mode and not require the use of a network, software, computer, or server for local control functions.
5. NX Room Controller(s) shall have an embedded Time Clock and be capable of storing and running up to 99 local schedules. Schedules shall run autonomously without the need of any coordinator, gateway, or master controller.
6. Construction:
   a. NX Room Controller housing shall be constructed of GSM UL rated 94 HB plastic approved for use in a return air plenum.
   b. The housing and shall include an integral 1/2" chase nipple for external mounting to standard junction box knockout.
   c. Two RJ45 FX Port connectors shall be accessible on the side of the enclosure for expansion of a Zone Segment to allow for an expanded number of Zone Segment devices (e.g., Room Controllers, In-Fixture Modules, and Digital Sensors). Up to 32 controllers and devices can be daisy-chained together.
   d. Two RJ45 SmartPORT™ connectors shall be accessible on the side of the enclosure for the connection of NX room level devices.
   e. Two recessed push buttons and associated LED indicators shall be accessible on the top of the enclosure to provide override, status, setup, and testing functions.
7. Electrical:
   a. NX Room Controller(s) shall have a single power feed and shall be capable of operation at voltages between 120/277/347 volts AC, 50/60 Hz.

b. One or two output relays (model specific) shall provide for the following load types and ampacity (per relay):
   1) 20A, Tungsten,
   2) 20A, Magnetic Ballast,
   3) 16A, Electronic Ballast,
   4) 4) 1 H.P. Motor @ 120V, ¾ H.P. @ 277V; ½ H.P. @ 347V
c. Where indicated provide one or two independent 0-10 volt dimming channels (model specific) for full range dimming control of fixtures equipped with compatible dimmable ballast or driver.
d. Each dimming output shall have a current sinking capacity of at least 30 mA.
e. NX Room Controller(s) shall be capable of supplying 250 mA of Class 2 auxiliary DC power for use by wall switch stations, occupancy sensors, and daylight sensors connected to the room controller's two RJ45 SmartPORT connectors.
f. NX Room Controller(s) shall be equipped with power monitoring circuitry capable of measuring and reporting the total connected load for each roomcontroller.

8. Functional:
   a. Provide an integral pushbutton and LED indicator for each load for status and to allow operation of the relays and dimmers for testing and verification without requiring other control devices to be connected.
   b. NX Room Controller(s) shall have a default operation providing an automatic logical sequence of operation for each load as the room control devices are plugged into the SmartPORT connectors.
   c. Default operation for occupancy sensors shall be automatic on, automatic off for all loads.
   d. Upon connection of a switch, the operation shall automatically change to manual on, automatic off (vacancy) mode for all loads.
   e. Provide capability to convert each load independently to automatic on or vacancy mode using only the integral push buttons and LED indicators on the room controller.
   f. When in vacancy mode, provide a 30 second grace period after an off during which automatic on shall be temporarily enabled.
   g. It shall be possible to connect up to thirty-two (32) room controllers together on the FX Ports using Cat5 patch cables to provide configurations up to 64 switched and dimmed loads operating as a single zone.
   h. Provide the following set up and configuration functions without the need for additional devices or software:
      1) Assign/reassign relays for control by wall switch station buttons,
      2) Configure relays for occupancy or vacancy operation,
      3) Assign/reassign dimmers to raise/lower switches,
      4) Assign dimming channels for response to daylight sensor control,
      5) Auto calibrate default daylight sensor sequence of operation,
      6) Save preset scenes.

9. NX Room Controller(s) shall support the following specialty modes:
   a. SpectraSync™ CCT Control
      1) Dimmer channels can be set individually to control CCT via 0-10V.
      2) Scheduling can be implemented to mimic the natural transition of light throughout the course of the day.
      3) Room-based solutions can be implemented to allow occupants to tune color to task.
   b. SpectraClean™
      1) Ability to control SpectraClean enabled fixtures with three different modes for varying applications:
         a) Constant On
         b) Scheduled
         c) Programmed Dosage

2.4 UL924 LOAD CONTROLLER

A. NX UL924 Load Controller

1. Basis of Design Product: Hubbell Control Solutions, NX UL924 Load Controller.
2. As indicated and where shown on the plans, install Hubbell Control Solutions NX UL924 Load Controller to control the quantity of emergency lighting loads required.
3. NX UL924 Load Controller shall meet NFPA Article 700 requirements for emergency lighting.
4. NX UL924 Load Controller and associated room control components shall operate in a totally standalone mode and not require the use of a network, software, computer, or server for local control functions.
5. NX UL924 Load Controller shall provide a remote test button or fire alarm interface.
6. NX UL924 Load Controller shall have an embedded Time Clock and be capable of storing and running up to 99 local schedules. Schedules shall run autonomously without the need of any coordinator, gateway, or master controller.
7. Construction:
   a. NX UL924 Load Controller housing shall be constructed of GSM UL rated 94 HB plastic approved for use in a return air plenum.
   b. The housing and shall include an integral 1/2" chase nipple for external mounting to standard junction box knockout.
   c. Two RJ45 FX Port connectors shall be accessible on the side of the enclosure for expansion of a Zone Segment to allow for an expanded number of Zone Segment devices (e.g., Room Controllers, In-Fixture Modules, and Digital Sensors). Up to 32 controllers and devices can be daisy-chained together.
   d. Two recessed push buttons and associated LED indicators shall be accessible on the top of the enclosure to provide override, status, setup, and testingfunctions.
8. Electrical:
   a. NX UL924 Load Controller shall have a single power feed and shall be capable of operation at voltages between 120/277/347 volts AC, 50/60 Hz.
   b. One relay output shall provide the following load types and ampacity:
      1) 20A, Tungsten,
      2) 20A, Magnetic Ballast,
      3) 16A, Electronic Ballast,
      4) 4) 1 H.P. Motor @ 120V, ¾ H.P. @ 277V; ½ H.P. @ 347V.
   c. NX UL924 Load Controller shall provide two independent 0-10 volt dimming channels for full range dimming control of fixtures equipped with compatible dimmable ballast or driver.
   d. Each dimming output shall have a current sinking capacity of at least 30 mA.
   e. NX UL924 Load Controller shall be equipped with power monitoring circuitry capable of measuring and reporting the total connected load for each room controller.
9. Functional:
   a. SmartPORT Functionality:
      1) NX UL924 Load Controller shall automatically recognize connected devices in the Zone Segment.
      2) NX UL924 Load Controller shall function as a standard room controller.
      3) NX UL924 Load Controller's RJ45 CAT5 connection shall be used as a sensing
      4) line to standard room controller only and does not support NX room devices.
   b. Emergency Functionality:
      1) NX UL924 Load Controller's RJ45 CAT5 connection shall be used as a sensing line to standard room controller on normal circuit.

2) Removal of 24VDC on CAT5 connection shall put NX UL924 Load Controller into emergency state.
3) NX UL924 Load Controller's default emergency state is ON with both dimming channels to 100%

c. Provide an integral pushbutton and LED indicator for controlled load for status and to allow operation of the relay and dimmers for testing and verification without requiring other control devices to be connected.
d. Provide the following set up and configuration functions without the need for additional devices or software:
1) Assign/reassign relays for control by wall switch station buttons,
2) Configure relays for occupancy or vacancy operation,
3) Assign/reassign dimmers to raise/lower switches,
4) Assign dimming channels for response to daylight sensor control,
5) Save preset scenes.

10. NX UL924 Load Controller shall support the following specialty modes:
a. SpectraSync™ CCT Control
1) Dimmer channels can be set individually to control CCT via 0-10V.
2) Scheduling can be implemented to mimic the natural transition of light throughout the course of the day.
3) Room-based solutions can be implemented to allow occupants to tune color to task.
b. SpectraClean™
1) Ability to control SpectraClean enabled fixtures with three different modes for varying applications:
a) Constant On
b) Scheduled
c) Programmed Dosage

2.5 FIXTURE MODULES

A. NX In-Fixture Modules

1. Basis of Design Product: Hubbell Control Solutions, NX In-Fixture Modules.
2. As indicated in the specifications and as shown on the plans, install Hubbell Control Solutions NXFM series Fixture Control Module enabled fixture(s).
3. NX In-Fixture Modules shall be designed to install inside the fixture they control.
4. NX In-Fixture Modules shall consist of a completely distributed intelligent lighting controller capable of functioning completely independently including time based and astronomical scheduling of On/Off and preset events without the need of any coordinator, gateway or master controller. Sensors and switches as well as other NX In-Fixture enabled fixtures shall be capable of being connected directly to the NX In-Fixture Module to create a fully functional lighting control system.
5. NX In-Fixture Module shall be provided with one SPST relay. Relay shall be supplied with "Zero Cross Switching" control to limit the effects of inrush on the relay contacts.
6. NX In-Fixture Module shall be compatible with incandescent, magnetic, and electronic lighting loads including LED drivers. NX In-Fixture Module shall include zero arc point switching circuitry and have the following max load ratings:
7. Construction:
a. Housing: GSM UL Rated 94 HB Plastic
b. Mounting: Mounts inside fixture
8. Electrical:
a. Line Voltage Versions:
1) Input: Universal 120-347VAC, 50-60Hz

2) Output: One or two relay outputs (model specific) shall provide for the following load types and ampacity (per relay):
   a) 10A, 120VAC only Incandescent
   b) 10A, 120-347VAC, Magnetic Ballast
   c) 5A, 120-277VAC, Electronic Ballast
   d) 3A, 347VAC, Electronic Ballast
3) Surge Withstand: 2000V
4) Peak Inrush: 160A for 2 ms Max

b. Low Voltage Versions:
   1) Input: 12-24VDC

c. NX In-Fixture Modules shall be provided with two 0-10VDC control interfaces for full range dimming control of dimming ballasts and LED drivers. Interface shall be designed to continuously sink 30mA of current.

d. NX In-Fixture Module 0-10VDC control interfaces shall be configurable for 0- 10VDC dimming, dim to off or color temperature control.

9. Functional:
   a. NX In-Fixture Modules shall be designed to self-configure, automatically to meet energy code requirements as NX sensors and other NX devices are connected.
   b. NX In-Fixture Module shall be designed such that self-configuration takes place automatically without user intervention or commissioning of any kind.
   c. NX In-Fixture Modules shall be rated and tested for an operating temperature range of -40° to 185°F [-40° to 85°C].
   d. NX In-Fixture Module shall be equipped with a Real Time Clock and integral backup for schedule information. Each module shall support up to 99 schedules. Schedules shall be loaded to the module via the network or locally using the NX controlHUBB App. Once loaded, schedules shall run autonomously without the need of any coordinator, gateway, or master controller.
   e. NX In-Fixture Module shall be capable of having its device firmware updated wirelessly over the air when connected to a NX sensor of via the NX SmartPORT.
   f. NX In-Fixture Modules shall be supplied with one momentary pushbutton with LED for manual control and testing. Through the use of this switch, it shall be possible to test the On/Off and dimming functionality of the NX In-Fixture module or completely reset the NX In-Fixture Module to factory defaults without the need to connect any other device or testing equipment.
   g. NX In-Fixture Module shall include non-volatile memory for retaining device settings during power outages.
10. NX In-Fixture Module shall be UL Listed to UL916 and Certified to CAN/CSA C22.2 NO 205- M1983.
11. NX In-Fixture Module shall be FCC certified.

B. NX On-Fixture Modules
   1. Basis of Design Product: Hubbell Control Solutions, NX On-Fixture Module.
   2. As indicated in the specifications and as shown on the plans, install Hubbell Control Solutions NXOFM series wireless On-Fixture Control Module(s).
   3. NX On-Fixture modules shall consist of a completely self-contained distributed intelligent wireless lighting controller capable of functioning completely independently including time based and astronomical scheduling of On/Off and preset events without the need of any coordinator, gateway or master controller.
   4. NX On-Fixture Module shall be configurable remotely over the air utilizing built in Bluetooth radio an iOS or Android handheld device with the NX controlHUBB App installed or via NX Wireless HubbNET network.
   5. NX On-Fixture Module shall be capable of having its device firmware updated wirelessly over utilizing it's built in Bluetooth radio and iOS or Android handheld device with the NX controlHUBB App installed or via NX Wireless HubbNET.

6. On-Fixture Module shall respond to scheduled events, occupancy/vacancy sensor events and manual switch station events.
7. On-Fixture Module shall monitor and measure energy consumption.
8. On-Fixture Module shall include non-volatile memory for retaining device settings during power outages.
9. NX On-Fixture Modules shall be rated and tested for an operating temperature range of -40° to 185°F [-40° to 85°C].
10. NX On-Fixture Module shall include one SPST relay for On/Off control.
11. NX On-Fixture Modules relay shall be supplied with “Zero Cross Switching” control to limit the effects of inrush on the relay contact.
12. NX On-Fixture Module shall be compatible with incandescent, magnetic, and electronic lighting loads including LED drivers.
13. Construction:
    a. Housing: GSM UL Rated 94 HB Plastic
    b. Mounting: Standard C136-41 (2013) with 5 or 7 pin twist-lock connector. Compatible with C136-10 sockets.
14. Electrical:
    a. Input: 120-480VAC, 50-60Hz
    b. Output: Relay output shall provide for the following load types and ampacity:
        1) 5A@120-347VAC,
        2) 3A@480V
    c. Surge Withstand: 2000V
    d. Peak Inrush: 160A for 2 ms Max
    e. Standby Power (W):
        1) 120VAC: 1.2
        2) 277VAC: 1.5
        3) 347VAC: 1.5
        4) 480VAC: 1.3
15. Functional:
    a. On-Fixture Module shall include an integrated daylight sensor with a foot candle range as shown below:
        1) On level: 1FC to 5FC (Default: 5FC)
        2) Off level: 4FC to 15FC (Default: 8FC)
    b. NX On-Fixture Modules shall communicate with other NX enabled fixtures and devices via HubbNET wireless mesh network with the following characteristics:
        1) Robust & reliable IEEE 802.15.4 2.4GHz wireless self-organizing and self-healing mesh network
        2) Radio Range: Outdoor: ~1000 ft. (~300m) Note: Range based on clear line of site.
        3) Security: AES-128 (Advanced Encryption Standard)
16. NX On-Fixture Module shall include non-volatile memory for retaining device settings during power outages.
17. NX On-Fixture Module shall UL Listed to UL916 and Certified to CAN/CSA C22.2 NO 205- M1983.
18. NX On-Fixture Module shall be FCC certified.

2.6 LIGHTING CONTROL PANELS

A. NX Lighting Control Panels

1. Basis of Design Product: Hubbell Control Solutions, NX Lighting Control Panels.
2. As indicated and where shown on the plans, install Hubbell Control Solutions NX Series Lighting Control Panels.

3. Panel shall be a fully distributed intelligent lighting controller with the ability to function as a stand-alone lighting control panel or as part of an NX networked system.
4. Panel shall provide standard capacities for 8, 16, 24, 32, or 48 relays in each panel with matching number of 0-10v dimming channels.
5. Panel shall be available in custom configurations. Configuration options shall include: panel shipment type (enclosure/interior shipped together, enclosure/interior shipped separately, enclosure only, and interior only), panel size, number of single pole/double pole relays, emergency control option, input voltage and enclosure mount (surface mount or flush mount).
6. Panels shall be factory assembled and tested. No field assembly shall berequired.
7. Construction:
    a. Panel shall be surface or flush wall mounted in a NEMA1 rated enclosure, based on panel configuration.
    b. Panel shall be capable of being shipped with enclosure/interior together, enclosure/interior separately, enclosure only, and interior only in appropriately designed packaging. When enclosure is shipped separately, enclosure shall enable rough-in of all electrical connections prior to receipt of the panel interior.
    c. Panel enclosure shall have standard electrical conduit knockouts on the top, the bottom and both sides of the enclosure to allow installation flexibility. Field drilling and cutting for pipe and wire shall not be required.
    d. Panel shall provide keyhole mounting holes in the rear of the enclosure.
    e. Panel enclosure shall include 6” spacing running the width of the panel at the bottom of the panel to allow for line voltage accessories such as contactors or to provide a “gutter”. Space shall be separated from the low voltage area utilizing a removable metal barrier. No knockouts added to the bottom plate of the inner high voltage divider. Exterior enclosure will maintain knockouts on bottom.
    f. Panel venting shall conform to NEMA 1 enclosure specifications to contain any local explosion and to protect the working environment.
    g. Panel enclosure shall feature removable metal barriers that separate all high-voltage components and wiring (Class 1) from all low-voltage (Class 2) components and wiring.
    h. Panel enclosure shall be of welded construction primed and painted with a powder coat finish. Unpainted or galvanized enclosures are not acceptable.
    i. Panel cover shall attach to the enclosure with #10-32 x ½” truss head machine screws.
    j. Panel cover shall employ “keyhole” style openings for the top two mounting screws to allow the panel’s cover to be temporarily hung during installation eliminating the need to completely remove all the mounting screws along with contributing to safety ensuring the cover does not swing if all screws were removed.
        1) 8 Relay panel cover – 4 mounting holes: 2 keyhole style slots, 2 slotted style slots
        2) 16/32 Relay panel cover – 6 mounting holes: 2 keyhole style slots, 4 slotted style slots
        3) 48 Relay panel cover – 8 mounting holes: 2 keyhole style slots, 6 slotted style slots
    k. Panel cover shall be sized for either surface or recess mounting of thepanel.
    l. Panel cover shall have hinged locking door to expose only the low voltage wiring section of the panel.
    m. Panel door hinges shall be located on the left side.
    n. Panel shall be provided with a factory or field installable panel interior. Panel interior shall contain all controller electronics, power supplies, relays, and other required components. Panel shall arrive at the project site completely pre-wired and requiring only the connection of lighting circuits and network cable. Systems that require field assembly of controllers or chassis inserts are not acceptable

o. Panel interior components shall reside on a framed skeleton. When disconnected from the load circuits and necessary mounting connections, the framed skeleton can be removed taking all the electrical components intact.
p. Panel interior components shall be designed to not become dislodged during shipment.
q. Panel spacing between panel relays shall be suitable for separating any two relays in the panel to meet the NEC requirements for normal and emergency power when a metal divider is installed between relays. A metal plate barrier shall be available to separate relays - two plates per application.
r. Panel relays shall be of the snap-in type and be individually field replaceable.

8. Electrical:
a. Panel shall be supplied with either a 120V/277V, 347V or 480V power supply.
b. Panel power supply shall provide the required capacity for the operation of the panel, relays, controllers, HubbNET PoE, SmartPORTs, user interfaces and the maximum number of low voltage and/or data devices that can be connected to each panel.
c. Panel wire connections shall be made to labeled terminal blocks.
d. Panel shall have LED status/failure indicators.
e. Panel shall provide support for Bluetooth programming using the NX controlHUBB app and the NX Bluetooth Radio Bridge with Clock or a SmartPORT connected NX sensor.
f. Panel shall include two (2) Ethernet ports for connection to the NX HUBBnet network.
g. Panel shall include four (4) RJ45 NX SmartPORTs for the connection of all NX sensors and switches. SmartPORTs shall be capable of supplying 250 mA of Class 2 auxiliary DC power for use by wall switch stations, occupancy sensors, and daylight sensors connected to the SmartPORT connectors
h. Panel shall have four (4) 3-wire low voltage dry contact inputs. Removable terminal blocks shall be provided to support momentary or maintained closures from building automation systems, fire systems, demand response and security systems as well as other systems or devices including occupancy sensors, daylight sensors, and low voltage switches. Each input shall be individually programmable and provide the ability to initiate any NX switch compatible function or command. (on, off, raise, lower, preset, timed on/off). Each input will provide a connection for sourcing 24V, a common, control and pilot light functionality for low voltage switch stations.
i. Panel shall have two (2) SPDT (NO/NC) dry contact outputs, with removable terminal blocks, to provide a contact closure to signal out to another system that is capable of receiving a NO or NC closure to signal building automation, security or alarm system based on a schedule or a command from an input device (e.g. occupancy sensor, daylight sensor, wall switch station, etc.). Each output will have a contact rating of 24VDC@50mA minimum.
j. Panel shall have an easily accessible, removable coin size battery for maintaining system time during a power loss.
k. Panel shall, after a power loss, retain time for a minimum of 72 hours.
l. Panel time shall be updated when connected to a device utilizing the NX controlHUBB app or from an NX network time server.
m. Panel shall feature an optional power sensing circuit and backup battery for UL924 operation. Upon detection of loss of power, the panel shall force all relays closed and all dimming channels to full bright. Panel shall maintain this state for 90 minutes. Connected devices will not be powered.
n. Panel shall have a battery test button on the optional power sensing circuit to test the battery with a derangement (audio) signal and LEDindicators.
o. Panel shall provide relay/dimmer boards to expand panel capacity from 8 to 48 relay outputs in groups of 8. Relay/dimmer boards shall be completely self-configuring and shall not require manual settings to configure for use within the panel.

p. Panel relay/dimmer boards shall confirm relay presence and status.
q. Panel relay/dimmer boards shall have (8) 0-10V integrated dimming channels, each capable of sinking 50mA.
r. Panel dimming channels shall be software assignable.
s. Panel shall be capable of containing 1 to 48 robust and reliable mechanically latching lighting control relays as indicated on the drawings and schedules as specified herein. Electrically held or non-mechanically latching relays shall not be considered.
t. Panel relays shall be individually UL and CUL listed and shall bear labels indicating compliance. Lighting control relays shall be tested to UL standard 508 for both safety and endurances and bare labels signifying compliance.
u. Panel relays shall have the following load ratings:
    1) Single Pole Relays:
        a) General Use: 30A @ 300VAC
        b) Tungsten: 2400W @ 120VAC
        c) Standard Ballast: 20A @ 300VAC
        d) Motor Starting: 1HP @ 110-125VAC; 1½ HP @ 220-277VAC
    2) Double Pole Relays:
        a) General Use: 20A @ 480VAC
        b) Tungsten: 2400W @ 120VAC
        c) Standard Ballast: 20A @ 480VAC
        d) Motor Starting: 1HP @ 110-125VAC; 1½ HP at 220-277VAC
v. Panel relays shall be rated for minimum cycle life of 120,000+ operations (60,000+ cycles).
w. Panel relays shall have a Short Circuit Current Rating (SCCR) of 18,000A @ 277VAC.
x. Panel relays shall have a built-in manual override lever & ON/OFF indicator.
y. Panel relays shall be capable of manual activation On or Off with or without power.

9. Functional:
a. Panel shall be of the distributed intelligence type and shall not be dependent on a network connection to execute schedules or perform programmed functions.
b. Panel shall be programmed using the optional NXBTC Bluetooth® radio module with clock and NX Bluetooth controlHUBB App. When networked, panel configurations shall be performed utilizing the NX Area Controller's web-browser based Graphical User Interface.
c. Panel shall provide the ability to update panel firmware. Firmware update process shall ensure that the complete and correct firmware (e.g. via CRC check) has been downloaded before the panel is flashed with the new firmware.
d. Panel set up and configuration functions shall include (but are not limited to):
    1) Assign/reassign relays for control by wall switch station buttons,
    2) Configure relays for occupancy or vacancy operation,
    3) Assign/reassign dimmers to raise/lower switches,
    4) Assign dimming channels for response to daylight sensor control,
    5) Assign names to relays/dimmers,
    6) Auto calibrate default daylight sensor sequence of operation,
    7) Create and save preset scenes,
    8) Configure wall switch button types. At a minimum, button types shall include toggle on/off with pilot, preset, on only and off only,
    9) Configure up to six zones of daylight harvesting per room with independent set points and time delays,
    10) Include or exclude loads from occupancy sensor control,
    11) Configure up to 16 load groups per zone,
    12) Configure up to 16 preset scenes per zone with independent fade times,
    13) Set independent power up conditions for relays and dimmers,
    14) Set independent occupied and unoccupied conditions for each relay and dimmer,

15) Adjust dimmer high and low trim points,
16) Manually control lighting loads

e. Panel shall provide the ability to create up to ninety-nine (99) schedules. Each schedule will consist of the following:
1) Event Time – Shall be configured as a specific set “Normal” time (hh:mm am/pm) or as an offset based on one of the following: Before Sunrise, After Sunrise, Before Sunset, After Sunset, Before Open, After Open, Before Close or After Close.
2) Action – Task to be performed: None, Group State, or activation of a Preset.
3) None – No action to perform
4) Group State – The specific relay / dim level / color temp range settings, that the select group(s) of actuators should implement.
5) Presets – The specific preset that should be activated.

f. Panel shall provide the ability to disable a schedule
g. Panel shall provide the ability to delete a schedule

2.7 CONTROLLED RECEPTACLES

A. HCS Controlled Receptacle

1. Basis of Design Product: Hubbell Control Solutions, HCSREC Series Controlled Receptacle.
2. Controlled Receptacle shall be capable of controlling other receptacles downstream in the branch circuit.
3. Controlled Receptacle shall be automatically controlled by a low voltage signal from an occupancy sensor or any other type of control capable of performing this task, e.g., time-of-day control device.
4. Controlled Receptacle shall be available in split or fully controlled 15A or 20A models.
5. Controlled Receptacle shall feature permanent NEC 406.3 (E) markings.
6. Controlled Receptacle shall be UL498B SA Listed Receptacles with integral switching that complies with Supplement SA.

2.8 SENSORS

A. NX Smart Sensor Module, Wireless Occupancy & Daylight Sensor

1. Basis of Design Product: Hubbell Control Solutions, NX Smart Sensor Modules.
2. As indicated in the specifications and as shown on the plans, install Hubbell Control Solutions NXSMP series sensor module enabled fixture(s).
3. NXSMP Series Sensor Module shall be designed to install directly into or on the fixture housing or lens.
4. NXSMP Series Sensor Module Occupancy/Vacancy sensor shall provide automatic or vacancy switching of lighting load(s) within an area/zone based on the presence of human activity.
5. NXSMP Series Sensor Module Occupancy/Vacancy sensor shall be microprocessor controlled and utilize IntelliSCOPE™ technology to provide real-time graphical occupancy data.
6. NXSMP Series Sensor Module Occupancy/Vacancy sensor shall not require any adjustments of any kind at the time of installation or during operation.
7. NXSMP Series Sensor Module Occupancy/Vacancy sensor shall be powered by SmartPORT™ using plenum rated SmartPORT plug and play cables.

8. NXSMP Series Sensor Module Occupancy/Vacancy sensor shall have a timer that can be adjusted manually from 1 second to 20 minutes.
9. NXSMP Series Sensor Module Occupancy/Vacancy sensor sensitivity shall be adjustable from 1 to 10.
10. NXSMP Series Sensor Module Occupancy/Vacancy sensor shall include non-volatile memory for retaining device settings during power outages.
11. NXSMP Series Sensor Module Occupancy/Vacancy sensor shall have RED real time motion indicator LED visible from the front of the unit.
12. NXSMP Series Sensor Module Occupancy/Vacancy sensor may be programmed for active and inactive times.
13. NXSMP Series Sensor Module Occupancy/Vacancy sensor shall be available with the following 360° coverage patterns:
    a. SMI/LMI – 1:1 (mounting height to radius) up to 14 feet
    b. OMNI – 1:1.5 (mounting height to radius) up to 14 feet
    c. LMO – 1:3 (mounting height to radius) up to 16 feet
    d. HMO – 1:1.4 (mounting height to radius) up to 45 feet indoors / 32 feet outdoors
14. NXSMP Series Sensor Module daylight sensor shall continually measure the amount of visible light under the lighting fixture to provide continuous On/Off and full range dimming control of fixture or group under its control.
15. NXSMP Series Sensor Module daylight sensor shall utilize a closed loop daylight harvesting algorithm to maintain the required light level in response to changes in daylight.
16. NXSMP Series Sensor Module daylight sensor shall have independently programmable ramp up and ramp down times to allow the sensor to respond quickly to decrease in daylight and respond more slowly to increase in daylight to minimize the effect of sudden changes in daylight.
17. NXSMP Series Sensor Module daylight sensor shall be capable of being programmed for active and inactive times.
18. NXSMP Series Sensor Module daylight sensor shall include non-volatile memory for retaining device settings during power outages.

B. NX Occupancy Sensors, Wired

1. Basis of Design Product: Hubbell Control Solutions, NX Occupancy Sensors.
2. NX Occupancy Sensors shall be ceiling or wall mounted and use dual technology (ultrasonic and passive infrared), ultrasonic and/or passive infrared (model specific) sensing technology as indicated.
3. NX Occupancy Sensors shall be Class 2 and connect to any room controller SmartPORT using a wiring adaptor and standard Cat5 patch cable.
4. NX Occupancy Sensors shall be microprocessor controlled and utilize IntelliDAPT® technology to optimize sensor behavior to adapt to space conditions and occupant usage patterns and adjust sensitivity and time delay to maximize energy savings and minimize false On and Off events
5. NX Occupancy Sensors shall be self-adaptive and not require manual calibration after installation. Digital circuitry and logic shall automatically adjust the sensitivity and time delay based on learned occupancy patterns and the environment in which the sensor is installed.
6. NX Occupancy Sensors using both ultrasonic and passive infrared (dual technology) shall operate such that detection by both technologies is required to initiate occupancy and continued detection by either technology will maintain occupancy.
7. Up to four NX Occupancy Sensors may be connected to one room controller.

C. NX Occupancy Output Interface

1. Basis of Design Product: Hubbell Control Solutions, NXRO Series Occupancy Output Interface Module.
2. NX Occupancy Output Interface shall communicate the occupancy state of an NX control zone to HVAC or other building systems using a contact closure.
3. NX Occupancy Output Interface shall connect to a SmartPORT™ and provide the aggregate occupancy state of the zone as reported by one or more occupancy sensors.
4. NX Occupancy Output Interface shall mount to a standard 4 11/16" junction box.
5. NX Occupancy Output Interface shall have a removable terminal block for input connection.
6. NX Occupancy Output Interface shall be powered by NXSmartPORT.
7. NX Occupancy Output Interface shall support multiple occupancy sensors in a zone.
8. NX Occupancy Output Interface shall feature a low voltage Form-C relay for Normally Closed / Normally Open operation.
9. NX Occupancy Output Interface shall be a low voltage device: 24VDC.

D. NX Daylight Sensor, Wired

1. Basis of Design Product: Hubbell Control Solutions, NXDS Series Daylight Sensor.
2. NX Daylight Sensor shall provide ambient light level information to the room controller allowing daylight responsive lighting control.
3. The system shall operate in an open loop sequence of operation reducing the amount of electric light as the quantity of daylight entering the room increases.
4. It shall be possible to configure up to six daylight zones in a room. Each zone shall be programmable to proportionally respond to the light level provided by the daylight sensor.
5. NX Daylight Sensor shall be mounted vertically or horizontally and positioned to provide an unobstructed view of the windows per the manufacturer's directions.
6. NX Daylight Sensor shall be available in indoor and outdoor models.
7. NX Daylight Sensor shall have an architecturally attractivedesign.
8. NX Daylight Sensor shall have a foot-candle range: 3-6,000FC

E. NX Wall Partition Sensor

1. Basis of Design Product: Hubbell Control Solutions, NXWPS Series Wall Partition Sensor.
2. NX Wall Partition Sensor shall automatically signal to the NX lighting control system when a moveable partition has been opened or closed. This allows the two adjacent rooms to be combined or separated into individual rooms.
   a. NX controls shall automatically reconfigure to operate in unison when rooms are combined.
   b. NX controls shall automatically reconfigure to operate independently when the rooms are separated.
   c. NX system shall allow for room combine scenarios with up to 16 combinable rooms.
3. NX Wall Partition Sensor shall be a low voltage device: 24VDC.

F. NX Contact Closure Interface

1. Basis of Design Product: Hubbell Control Solutions, NXCI Series Contact Closure Interface.
2. NX Dry Contact Closure Interface shall enable third-party devices to provide dry contact inputs to the NX lighting control system.
3. NX Dry Contact Closure Interface shall provide switch activation using contact closures from external devices such as key switches, AV systems, photo-eye sensors or other low voltage Class 2 devices.
4. NX Dry Contact Closure Interface shall default to On/Off operation and can be programmed to perform alternate functions including:
   a. Toggle On/Off

b. Preset
c. Raise
d. Lower
e. Timed On

5. NX Dry Contact Closure Interface shall feature a removable terminal block for input connection.
6. NX Dry Contact Closure Interface shall feature pilot light output terminals.
7. NX Dry Contact Closure Interface shall be a low voltage device: 24VDC.

2.9 WALL STATIONS

A. NX SimpleTouch™ Graphic Wall Station

1. Basis of Design Product: Hubbell Control Solutions, NX SimpleTouch Graphic Wall Station.
2. Graphic Wall Station shall employ a 3.5” resistive LCD-TFT, full-color touch screen with 320x480 screen resolution in portrait orientation.
3. Graphic Wall Station shall mount to a standard single gang switch box.
4. Graphic Wall Station shall utilize standard Cat5 cabling for connection to system SmartPORT. Provide two RJ45 ports to allow daisy chain connection with other NX Smart Switches.
5. Graphic Wall Station shall operate seamlessly with other NX Smart Switches.
6. Graphic Wall Station shall provide a 4GB microSD card for storing user preferences that include the quantity of controls per screen, function names, screen navigation, home screen selection, and custom screen saver graphic image.
7. Graphic Wall Station screens can be configured to meet project requirements for control of up to 16 groups, each with provision for On/Off and dimming, up to 16 preset scenes, or CCT color control.
8. Graphic Wall Station shall be capable of local control within a single space or configured for master control across spaces or building wide.
9. Graphic Wall Station shall have an optional password access control that will require a secure PIN to access the station.
10. Graphic Wall Station shall have adjustable screensaver timeout and backlight brightness.
11. Graphic Wall Station shall be supplied with a white bezel. Optional color change kit shall allow for Ivory, Grey, Light Almond, or Black.

B. NX Smart Switches

1. Basis of Design Product: Hubbell Control Solutions, NX NXSW Series Smart Switches.
2. NX Smart Switches shall be of the programmable type using standard Cat5 cabling for connection to system SmartPORT™.
3. NX Smart Switches shall have one to six buttons and provide lighting control functions as called out and shown on the plans.
4. NX Smart Switches shall be available with the following specialty versions:
   a. OO: On/Off
   b. ORLO: On/Raise/Lower/Off
   c. RL: Raise/Lower
   d. TO: Timed-On
   e. SS: Scene
5. Construction:
   a. Housing: Rugged, high impact, injection molded plastic
   b. Mounting: Switches shall be capable of being mounted to single-gang and multi-gang wall boxes and shall be compatible with standard decorator style wall plates.

6. Electrical:
   a. Class 2 Low Voltage 24VDC
   b. Connection via two (2) RJ-45 SmartPORTs to allow for daisy chain connection of up to eight switches to each SmartPORT.
7. NX Smart Switches shall be available in White, Ivory, Light Almond, Gray, Black, and Red.

C. NX Audio Visual Interface Module

1. Basis of Design Product: Hubbell Control Solutions, NXAVM Series Audio Visual Interface Module.
2. NX Audio Visual Interface Module shall enable third-party systems to digitally interface with an NX light control system.
3. NX Audio Visual Interface Module shall provide an ASCII based command set to interface with third-party systems such as Audio-Visual systems to send commands to and receive query status from a NX system
4. NX Audio Visual Interface Module shall feature a DB9 connector and support RS232 serial communication, providing control and status for a single zone.
5. NX Audio Visual Interface Module shall mount to a standard 4 11/16” junction box.

2.10 NETWORK AREA CONTROLLER

A. NX Area Controller

1. Basis of Design Product: Hubbell Control Solutions, NXAC Series Area Controller.
2. NX Area Controller shall provide a simple and highly intuitive graphical user interface (GUI) to the NX Distributed Intelligence Lighting Control System via a personalcomputer.
3. NX Area Controller shall enable any PC with a standard web-browser to interface with the NX system through a built-in web server.
4. NX Area Controller shall enable system users to easily program, monitor and control (locally or remotely) the functions of the NX system.
5. NX Area Controller shall connect to the NX HubbNET™ network providing communication with the NX Room Controllers, NX Lighting Control Panels, NX SmartPORT™ Modules and other wired NX system components.
6. NX Area Controller shall have the ability to communicate by means of TCP/IP over Ethernet allowing enterprise connectivity between the NX Distributed Lighting Control System and external LAN or WAN networks.
7. NX Area Controller shall use NX Wireless Access Points to extend connectivity to NX Wireless Room Controllers and Fixture Modules.
8. NX Area Controller shall be capable of communicating with Building Automation System via an embedded BACnet™ client using the BACnet IP protocol.
9. NX Area Controller shall enable the connection of multiple users simultaneously.
10. NX Area Controller shall feature user account/password management.
11. Construction:
    a. NX Area Controller electronics shall be housed in a NEMA 1 industrial grade enclosure suitable for surface wall mounting in an electrical/mechanical room.
    b. The enclosure shall measure 13.5" H x 14.5" W x 4" D and include a screw on cover with a hinged locking door.
    c. Provide standard knock outs eliminating the need for field drilling or cutting of the enclosure which could damage the electronics.
12. Electrical:
    a. NX Area Controller shall have a 120VAC, 60Hz hard wired supply connection. Servers or controllers using plug-in type power sources shall not be acceptable.

13. Functional:
    a. NX Area Controller shall function as a web server allowing the user interface to be accessible through a standard web browser.
    b. The installation of software shall not be required. At a minimum, the user interface shall provide the following functions:
        1) Automatic discovery of NX system devices
        2) Commissioning of devices into logical Areas and Zones, provide a minimum of 128 areas each with 128 zones
        3) Display the entire system in a logical navigation tree view
        4) Allow the user to name Zones, Groups, Presets, Schedules and individual loads
        5) Set up control functions for system inputs and outputs
        6) Monitor status and override individual relays and dimmers
        7) Set up and download schedules to panels and room controllers
        8) Monitor real-time power use at each room controller

2.11 NETWORK MODULES

A. NX Network Bridge Module

1. Basis of Design Product: Hubbell Control Solutions, NX Network Bridge Module.
2. NX Network Bridge Module shall allow multiple room controller zones to be networked with other NX system devices for whole building administration of lighting control functions.
3. NX Network Bridge Module housing shall measure 5.75" X 3.85" X 1.3"and be constructed of GSM UL rated 94 HB plastic approved for use in a return air plenum.
4. NX Network Bridge Module shall connect to and be powered from a room controller SmartPORT via a standard Cat5 cable.
5. NX Network Bridge Module shall provide RJ-45 ports for in and out connection points for an Ethernet based network.
6. NX Network Bridge Module shall provide a communication link between the room control devices and the NX system Area Controller via an Ethernet based network. At a minimum, the network link shall provide the following functionality through a web browser user interface:
    a. Report the current occupancy status for each lighting control zone
    b. Indicate the status of each relay and dimming channel
    c. Allow reconfiguration of system device input and output parameters
    d. Report the real time power consumption for each Room Controller
    e. Set up daylight harvesting for zones equipped with photocells
    f. Configure and download schedules to panels and Room Controllers

B. NX HubbNET™ Radio Module

1. Basis of Design Product: Hubbell Control Solutions, NXRM Series HubbNET Radio Module.
2. NX HubbNET Radio Module shall allow a luminaire equipped with the NXFM In-Fixture Module to be promoted wirelessly from standalone operation to full network participation.
3. NX HubbNET Radio Module shall plug into the SmartPORT™ connector on the NXFM In- Fixture Module and is mounted through an 1.25” aperture in the luminaire housing.
4. NX HubbNET Radio Module shall feature a low-profile housing for minimal visual impact.
5. NX HubbNET Radio Module shall feature an O-ring gasket to provide watertight seal to luminaire housing.
6. NX HubbNET Radio Module shall have an integrated and compact PCB F antenna and shall not require an external antenna.

7. NX HubbNET Radio Module shall integrate seamlessly into the NX HubbNET network.
8. NX HubbNET Radio Module shall have an RF frequency of 2.4GHz.

C. NX Network Interface Module:

1. Basis of Design Product: Hubbell Control Solutions, NXDHI Series Device Network Interface Module.
2. NX Network Interface Module shall provide network connection and power to accessory components including NX Dry Contact Interface and NX SmartPORT Modules.
3. NX Network Interface Module shall be discoverable by the NX Area Controller and controllable through web browser interface.
4. NX Network Interface Module shall repeat network communication signal to extend network length.
5. NX Network Interface Module shall feature integral link indicators confirming network segment status.
6. NX Network Interface Module shall feature a power LED indicator confirming presence of accessory DC power on NX HubbNET segment.
7. NX Network Interface Module shall feature dual RJ45 HubbNET input and output jacks to enable module to be inserted anywhere along the HubbNET network as needed.
8. Construction:
   a. Extruded and sheet aluminum
   b. Weight: 6 oz (170.1g)
   c. Mounting: 1.38” (35mm) DIN rail
9. Electrical:
   a. Input: 24VDC, 800mA max current via HubbNET network cable
   b. Output: 24VDC power supplied to connected accessory modules
10. NX Network Interface Module shall be Title 24 Compliant.

D. NX SmartPORT Module

1. Basis of Design Product: Hubbell Control Solutions, NX SmartPORT Module.
2. NX SmartPORT Module shall provide the ability to easily connect smart switch stations, motion detectors, and daylight sensors into the NX network system.
3. NX SmartPORT Module shall have (4) SmartPORTs each with (2) RJ45 connectors for convenient connection of multiple devices.
4. Devices connected to the SmartPORT module shall be network visible and configurable to operate with panels and room controllers via the web browser user interface.
5. NX SmartPORT Module shall be compatible with all NX Smart Switch Stations, NX Occupancy Sensors and NX Daylight Sensor.
6. NX SmartPORT Module shall feature DIN rail mounting.
7. NX SmartPORT Module shall be a low voltage device: 24VDC.

E. NX Dry Contact Interface Module

1. Basis of Design Product: Hubbell Control Solutions, NXDCIO Series Dry Contact Interface Module.
2. NX Dry Contact Interface Module shall provide a simple way to incorporate standard dry contact inputs and outputs into the NX lighting control system.
3. NX Dry Contact Interface Module shall accommodate dry contact input closures from building automation, fire, security, and many other types of systems.
4. NX Dry Contact Interface Module shall be programmable from the NX Area Controller.
5. NX Dry Contact Interface Module shall feature (6) individually programmable dry contact inputs with or without pilots.

6. NX Dry Contact Interface Module shall accommodate 2 and 3 wire inputs (momentary or maintained).
7. NX Dry Contact Interface Module shall feature (6) individually programmable Form-C dry contact outputs.
8. NX Dry Contact Interface Module shall have removable terminal blocks for easy connections.
9. NX Dry Contact Interface Module shall feature DIN rail mounting.
10. NX Dry Contact Interface Module shall be a low voltage device: 24VDC.

2.12 NETWORK ACCESSORIES

A. NX Bluetooth® Radio Bridge with Real Time Clock

1. Basis of Design Product: Hubbell Control Solutions, NXBTC Series Bluetooth Radio Controller.
2. NX Bluetooth Radio Bridge with Real Time Clock shall provide a wireless communication bridge for communications via iOS® or Android™ smart device apps.
3. NX Bluetooth Radio Bridge with Real Time Clock shall connect to and be powered by an NX SmartPORT™.
4. NX Bluetooth Radio Bridge with Real Time Clock shall use Bluetooth technology allowing the radio to easily pair with a smart phone or tablet.
5. NX Bluetooth Radio Bridge with Real Time Clock shall communicate with the NX system for setup and control from a smart device.
6. NX Bluetooth Radio Bridge with Real Time Clock shall feature a real time clock and allow schedules to be downloaded and run in stand-alone NX Room Controller applications without a network.
7. NX Bluetooth Radio Bridge with Real Time Clock shall provide password protections for user access preventing unauthorized Bluetooth connection of a smart device.
8. NX Bluetooth Radio Bridge with Real Time Clock shall use Bluetooth Version 4.1.
9. NX Bluetooth Radio Bridge with Real Time Clock shall feature an LED status indicator for successful connections.
10. NX Bluetooth Radio Bridge with Real Time Clock shall have a RJ45 plug-in connection to NX SmartPORT.
11. NX Bluetooth Radio Bridge with Real Time Clock shall be a low voltage 24VDC device.
12. NX Bluetooth Radio Bridge with Real Time Clock shall be rated for return air plenum

B. NX Media Converter

1. Basis of Design Product: Hubbell Control Solutions, NXEOF Series Media Converter.
2. NX Media Converter shall allow a transition from copper based ethernet to fiber.
3. NX Media Converter shall support 10BASE-T, 100BASE-TX, 100BASE-FX and IEEE 802.3 specifications.
4. NX Media Converter shall be a multimode converter and support up to 5km distance.
5. NX Media Converter shall include and RJ45 port that supports full/half-duplex auto-negotiation and MDI/MDIX auto-crossover.
6. NX Media Converter shall include LED indicators for RJ45 and fiber port status.
7. NX Media Converter shall include a wall mounting kit.

C. NX HubbNET™ PoE Switch

1. Basis of Design Product: Hubbell Control Solutions, NXPOE Series PoE Switch/Power Injector.

2. NX HubbNET PoE Switch shall provide the splitting of the HubbNET network from the NX Area Controller into multiple segments.
3. NX HubbNET PoE Switch shall provide seven powered RJ45 ports for connection of NX network devices.
4. NX HubbNET PoE Switch shall provide multiple dimming options including DMX to less than 0.1%.
5. NX HubbNET PoE Switch shall expand the capacity of the NX Area Controller to 448 bridges suitable for large commercial and architectural interiors.

D. NX Energy Dashboard

1. Basis of Design Product: Hubbell Control Solutions, EnergyHUBB NX Energy Dashboard.
2. NX Energy Dashboard shall provide real-time monitoring of energy consumption for the NX Lighting Control System.
3. NX Energy Dashboard shall provide monitoring for up to 300 zones.
4. NX Energy Dashboard shall report out power and energy consumption for a specific, user selected zone.
5. NX Energy Dashboard shall be able to export out consumption data in .csv format for third party applications.
6. NX Energy Dashboard shall provide a wide range of reporting & monitoring intervals from less than an hour to multiple years.
7. NX Energy Dashboard shall be able to manage user rights & permissions to access the dashboard portal.
8. NX Energy Dashboard shall be able to manage system configuration changes and network settings.
9. Construction:
    a. NX Energy Dashboard electronics shall be housed in a NEMA 1 polycarbonate enclosure suitable for surface wall mounting.
    b. NX Energy Dashboard enclosure shall measure 13.41"H x 11.41" W x 7.38" D and include a hinged locking door.
    c. NX Energy Dashboard enclosure shall be IP66 rated.
    d. NX Energy Dashboard components shall be mounted inside the enclosure on flat panel, 35mm DIN rail.
10. Electrical:
    a. Input: 120-240VAC, 60Hz hard wired supply connection.
11. Networking & Software:
    a. N4 Niagara Operating System.
    b. 10-Base T Ethernet via (2) RJ-45 ports.
    c. (1) Micro USB for serial shell access.
    d. (1) Mini-B USB port
    e. 4GB Internal flash memory for storage

E. NX Forward and Reverse Phase Dimming Converter

1. Basis of Design Product: Hubbell Control Solutions, NX Forward and Reverse Phase Dimmer Converter.
2. NX Forward and Reverse Phase Dimmer shall auto-sense forward and reverse phase dimming.
3. NX Forward and Reverse Phase Dimmer shall dim standard 120V or 277V lighting loads.
4. NX Forward and Reverse Phase Dimmer shall support up to 1300W max load.
5. NX Forward and Reverse Phase Dimmer shall provide dual 0-10V input and output ports.
6. NX Forward and Reverse Phase Dimmer shall provide an integrated 6.5ft flexible conduit.

7. NX Forward and Reverse Phase Dimmer shall be compatible with NX Room Controllers, NX Lighting Control Panels and Hubbell Control Solutions Low Voltage Dimming Switches.
8. Construction:
   a. Housing: Anodized aluminum
   b. Size: 4.01” L x 5.52” W x 1.88” H
   c. Complies with requirements for use in a plenum area
   d. Mounting: Surface mount with screws
9. Electrical:
   a. Input: 120/277VAC, 60Hz – Single feed input connection
   b. Output: 120/277VAC, 60Hz – Single feed output connection
   c. Low Voltage: Class 2, 0-10V Input and output
   d. Max Load Rating:
      1) 1) 120VAC: 700W
      2) 2) 277VAC – 1300W
   e. Min Load Rating: 24W
   f. Standby Power:
      1) 1) 120VAC: 0.75W
      2) 2) 277VAC: 1.87W
   g. Dimming:
      1) Class 2 / Class 1 (NOTE: Installation as Class 1 requires 600 volt insulation on dimming conductors sharing a conduit with line voltage conductors)

2.13 SOFTWARE INTERFACES

A. NX Area Controller Graphical User Interface (GUI):

1. NX Area Controller GUI shall serve as a primary interface for the networked lighting system, providing communication with lighting control panels, room controllers, fixture modules, and other wired system components and through wireless access point to wireless room controllers and fixture modules.
2. NX Area Controller GUI shall be accessible via conventional PC web browser through the NXAC Series Area Controller’s built-in web server.
3. NX Area Controller GUI shall enable users to program, monitor, and administer the NX Lighting Control System from any location without additional software.
4. NX Area Controller GUI shall include an embedded BACnet IP client that is field configurable, enabling integration of lighting control system and building automation system.

B. NX controlHUBB Mobile App

1. NX controlHUBB Mobile App shall provide Bluetooth® wireless setup and configuration of NX system devices and luminaires equipped with an NX In-Fixture Module and smart sensor.
   NX controlHUBB Mobile App shall be available in Android and iOS versions for free download from Google Play™ or Apple® App Store.
2. NX controlHUBB Mobile App shall communicate with NX Room Control devices via a NXBTR, NXBTC, or NXSMP sensor radio modules via Bluetooth BLE.
3. NX controlHUBB Mobile App shall enable easy setup and configuration of NX room devices and NX panels.
4. NX controlHUBB Mobile App shall enable users to create custom schedules and presets.
5. NX controlHUBB Mobile App shall be able to configure SpectraSync™ or SpectraClean™

6. enabled luminaires.
7. NX controlHUBB Mobile App shall globally discover wireless enabled luminaires and devices.
8. NX controlHUBB Mobile App shall include the IntelliSCOPE™ visual diagnostic tool for real- time calibration and testing of NX digital smart sensors.

2.14 CONDUCTORS AND CABLING

A. Power Supply Side of Remote-Control Power Sources: Comply with network manufacturer's requirements and requirements of Division 26 Section "Low-Voltage Electrical Power Conductors."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation, contractor shall examine work area to verify measurements, all wire type and routing requirements, and that commencing installation complies with manufacturer's requirements.

B. Where variations from the general specifications or drawings exist, the contractor shall request a clarification prior to rough in or installation

3.2 INSTALLATION

A. Lighting controls shall be installed in accordance with manufacturer’s instructions, guidelines and submittal documents provided by the lighting control manufacturer.

B. Lighting control system components shall only be installed in spaces that meet the following environmental conditions:

1. Temperature: 32 – 104 deg F (0 - 40 deg C).
2. Relative Humidity: 10 – 90 percent, noncondensing.

C. All stored and installed lighting control system components shall be adequately protected from dust and dirt.

3.3 SYSTEM STARTUP

A. The system manufacturer shall provide a factory authorized field engineer to the project site after installation has been completed and prior to system energization for the purpose of testing and adjustment of the system.

B. Factory field engineer shall test and verify all system functions and ensure proper operation of the system components in accordance with the specifications and on-site conditions. The installing contractor shall notify the system manufacturer in writing that the system is completely wired and ready to be energized and tested 2 weeks prior to scheduling a field engineer for start-up of the system. Should the field engineer arrive on the job site and find the installation

incomplete, the installing contractor shall pay the cost of any future visits by the field engineer required to complete the system start-up.

C. Factory field engineer shall provide a written report of test andoutcomes.

3.4 DEMONSTRATION AND TRAINING

A. Factory field engineer shall instruct owner's staff on how to adjust, operate and maintain lighting systems; and provide instruction using the system software.
1. Allow for up to 4 hours of on-site training on the use and maintenance of the lighting control system to be scheduled at the completion of startup and programming of the system.

3.5 TECHNICAL SUPPORT

A. Manufacturer shall provide reasonable access to factory direct telephone technical support during normal business hours.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General Conditions, and Division-01 Specification sections, apply to work of this section.

B. Requirements specified in all other sections of Division 26 apply to this Section.

1.2 SUMMARY:

A. Extent of panelboard, load-center and enclosure work, including cabinets and cutout boxes, is indicated by drawings and schedules, and as specified herein.

B. Types of panelboards and enclosures required for the project include the following:

1. Power-distribution panelboards.
2. Lighting and appliance panelboards.

C. Refer to other Division-26 sections for wires/cables, electrical boxes and fittings, and raceway work required in conjunction with installation of panelboards and enclosures.

D. Wires/cables, electrical boxes and fittings, and raceways required in conjunction with the installation of panelboards and enclosures are specified in other Division-26 sections.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's data on panelboards and enclosures.

B. Wiring Diagrams: Submit wiring diagrams for panelboards showing connections to electrical power feeders and distribution branches.

1.4 QUALITY ASSURANCE:

A. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects utilizing panelboards similar to those required for this project.

B. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Article 384 as applicable to installation, and construction of electrical panelboards and enclosures.
2. UL Compliance: Comply with applicable requirements of UL 67, "Electric Panelboards," and UL's 50, 869, 486A, 486B, and 1053 pertaining to panelboards, accessories and enclosures. Provide panelboard units which are UL-listed and labeled.

3. Special-Use Markings: Provide panelboards, constructed for special-use, with appropriate UL markings which indicate that they are suitable for special type of use/application.
4. NEMA Compliance: Comply with NEMA Stds Pub/No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)," Pub/No. PB 1, "Panelboards," and Pub/No. PB 1.1,"Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less."

C. Federal Specification Compliance: Comply with FS W-P-115, "Power Distribution Panel", pertaining to panelboards and accessories.

1.5 SEQUENCING AND SCHEDULING:

A. Coordinate installation of panelboards and enclosures with installation of wires/cables, electrical boxes and fittings, and raceway work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide panelboard products manufactured by:

1. Square D Co.
2. General Electric Co.
3. Cutler- Hammer / Eaton Electrical

2.2 PANELBOARDS:

A. General: Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials; with the design and construction in accordance with published product information; equip with proper number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for those applications indicated.

B. Overcurrent Protective Devices (OCPDs): Provide type, rating, and features as indicated. Comply with Division 26 Section "Overcurrent Protective Devices," with OCPDs adapted to panelboard installation. Tandem circuit breakers shall not be used. Multipole breakers shall have common trip.

C. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.

D. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the OCPD ampere ratings indicated for future installation of devices.

E. Feed-Through Lugs: Sized to accommodate feeders indicated.

F. Double-Main Lugs: Sized to accommodate feeders indicated. Provide custom sizes separate

from the integral main circuit breakers with internal factory wiring from the double main lugs to the integral main circuit breaker.

G. Special Features: Provide the following features for panelboards as indicated.

1. Split Bus: Vertical bus of indicated panels divided into two vertical sections with connections as indicated. Provide split bus panels for Normal -Emergency Loads, where indicated.
2. Contactors in Panels: Mechanically held, with current rating, poles, and connections as indicated.
3. All Panelboards and distribution boards: Provide both enclosure fronts and doors with full piano type hinges.

2.3 DISTRIBUTION PANELBOARDS

A. Branch-Circuit Breakers: Use bolt-on breakers.

1. Power Distribution Panelboards General: Provide dead-front safety type power distribution panelboards as indicated, with panelboard switching and protective devices in quantities, ratings, types, and with arrangement shown; with anti-turn solderless pressure type main lug connectors approved for use with copper conductors. Equip with copper bus bars with not less than 98-percent conductivity, and with full-sized neutral bus; provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Provide molded-case main and branch circuit-breaker types for each circuit, with toggle handles that indicate when tripped. Where multiple-pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously. Provide panelboards with bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards, which mate and match properly with panelboards. Provide enclosure fronts and doors with full piano type hinges.

B. Distribution panelboards shall be equal to Square D I-Line Power Distribution Panelboards. Power Distribution Panelboards shall be rated minimum R.M.S. Symmetrical as noted on the drawings for the 277/480 Volt and 120/208 Volt panelboards.

C.. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage, minimum 16-gage thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with full piano hinge, and doors with flush locks, piano hinge and keys, all panelboard enclosures keyed alike, with concealed piano door hinges and door swings as indicated. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor coating. Design enclosures for recessed mounting, where indicated. Provide enclosures which are fabricated by same manufacturer as panelboards, which mate and match properly with panelboards to be enclosed.

D. Special Features:

1. Surge Protection Devices (SPD): 120kA minimum, UL 1449 3rd edition compliant, bus connected without leads.
2. 84, 56 or 42 pole panelboards as shown on the contract drawings.
3. Arc-Flash labels: Provide an arc-flash label for the exterior of each panelboard.
4. Provide phase label color code chart for each panelboard to comply with the NEC.

2.4 LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS

A. Branch OCPDs: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Lighting and Appliance Panelboards General: Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types and arrangements shown; with anti-burn solderless pressure type lug connectors approved for use with copper conductors; construct unit for connecting feeders at top of panel; equip with copper bus bars, full-sized neutral bar, with bolt-in type heavy-duty, quick-make, quick-break, single-pole circuit-breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required; and provide bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards, which mate and match properly with panelboards.

1. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage, minimum 16-gage thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with piano hinge, and doors with piano hinge, flush locks and keys, all panelboard enclosures keyed alike, with concealed piano door hinges and door swings as indicated. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor coating. Design enclosures for recessed mounting. Provide enclosures which are fabricated by same manufacturer as panelboards, which mate and match properly with panelboards to be enclosed. Provide enclosure fronts and doors with full piano type hinges.

C. Double-Width Panels: Where more than 42 poles are indicated or where otherwise indicated, provide two panelboards connected by feed-thru lugs. Contractor shall provide wire and conduit between panels equal to the main incoming feeders.

D. Doors: In panel front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.

E. Molded-Case Circuit Breakers: Provide factory-assembled, molded-case circuit breakers of frame sizes, characteristics, and ratings including RMS symmetrical interrupting ratings indicated. Select breakers with permanent thermal and instantaneous magnetic trip, and with fault-current limiting protection, ampere ratings as indicated. Construct with overcenter, trip- free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle trip indication. Construct breakers for mounting and operating in any physical position, and operating in an ambient temperature of 40 deg C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

F. Panelboards shall be made by Square D, type NF. Panelboards shall be rated minimum R.M.S. Symmetrical as shown on the drawings for the 277/480V.

G. Panelboards shall be made by Square D, type NQ. Panelboards shall be rated minimum R.M.S. Symmetrical as shown on the drawings for the 120/208V panelboards.

H. Accessories: Provide panelboard accessories and devices including, but not necessarily limited to, time-delay type fuses, ground-fault protection units, etc., as recommended by panelboard manufacturer for ratings and applications indicated.

I. Special Features:

1. Provide bus-mounted 120kA Surge Protection Devise (SPD), UL 1449, 3rd edition listed, in panels, where noted on the drawings.
2. Provide enclosure fronts with full piano hinges and doors within the fronts with full piano hinges. Secure fronts with standard manufacturer fastening devices.
3. 84, 56, or 42 pole panelboards as shown on the contract drawings.
4. Arc-Flash labels: Provide an arc-flash label for the exterior of each panelboard.
5. Provide phase label color code chart for each panelboard to comply with the NEC.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which panelboards and enclosures are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF PANELBOARDS:

A. Install panelboards and enclosures as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC standards and NECA's "Standards of Installation," and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Ground Fault Protection: Install panelboard ground fault circuit interrupter devices in accordance with installation guidelines of NEMA 289, "Application Guide for Ground Fault Circuit Interrupters."

C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.

D. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored.

E. Provide properly wired electrical connections for panelboards within enclosures.

F. Fill out panelboard's circuit directory card upon completion of installation work.

G. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch empty conduits from panel into accessible ceiling space.

3.3 GROUNDING:

A. Provide equipment grounding connections for panelboard enclosures as indicated. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

3.4 FIELD QUALITY CONTROL:

A. Prior to energization of electrical circuitry, check all accessible connections to manufacturer's

tightening torque specifications.

B. Prior to energization of panelboards, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

C. Prior to energization, check panelboards for electrical continuity of circuits, and for short-circuits.

3.5 ADJUSTING AND CLEANING:

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finishes.

3.6 DEMONSTRATION:

A. Subsequent to wire and cable hook-ups, energize panelboards and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 262416

SECTION 262726– WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and Division 1 Specification Sections, apply to this and the other sections of Division 26.

B. Requirements specified in all other sections of Division 26 apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles
2. Plugs and Plug Connectors
3. Snap Switches
4. Ground Fault Circuit Interrupter Receptacles
5. Wall Plates

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 26 Section "Electrical Identification" for requirements for labels on wall plates.

1.3 SUBMITTALS

A. Product data for each type of product specified.

B. Samples of those products indicated for sample submission in Architect's comments on product data submittal. Include color and finish samples of device plates and other items per Architect's request.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with provisions of the following codes.

B. NFPA 70 "National Electrical Code".

1. UL and NEMA Compliance: Provide wiring devices which are listed and labeled by UL and comply with applicable UL and NEMA standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Inc., or approved equal.

2.1 WIRING DEVICES:

A. General: Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards. Verify color selections with Architect.

B. Receptacles: Comply with UL 498 and NEMA WD 1. Where not otherwise indicated, provide 20A heavy duty, specification grade tamper-resistant receptacles. Provide receptacles equal to Hubbell Wiring Devices BR20TR series. Verify color selections with Architect.

C. Where receptacles are wired to normal/emergency or emergency only circuits, provide red colored receptacles, with ratings equal to above.

D. Receptacles, Industrial Heavy Duty: Provide pin and sleeve design receptacles conforming to UL 498. Provide features indicated.

E. Ground-Fault Interrupter (GFI) Receptacles: Provide weather-resistant, tamper-resistant, "feed-thru" type ground-fault circuit interrupter, with integral commercial heavy-duty NEMA 5-20R duplex receptacles arranged to protect connected downstream receptacles on same circuit. Provide unit designed for installation in a 2-3/4 inch deep outlet box without adapter, grounding type, Class A, Group 1, per UL Standard 943. Provide receptacles equal to Hubbell Wiring Devices GFTWRST20 series, which comply with 2015 UL 943 for self-testing requirements. Verify color selections with Architect.

F. USB Charger Receptacles: Provide specification grade tamper-resistant NEMA 5-20R duplex receptacle with (2) integral USB ports; (1) USB Type A, providing 3 Amp, 5VDC, 2.0, complying with battery charging specification USB BC1.2, and (1) USB Type C, 5 Amp, 5VDC, 3.0 power delivery. USB charging shall be compatible with USB 2.0/3.0/3.1 devices, including Apple products. Provide receptacle equal to Hubbell Wiring Device-Kellems USB20AC5. Verify color selections with Architect.

G. Occupancy Controlled Receptacles (OCR): Provide permanently marked with universal power symbol, two faced controlled tamper-resistant receptacle. Receptacle shall comply with NEC 2014-406.3, ASHRAE 90.1, UL 498 and NEMA WD 6. Where not otherwise indicated, provide 20A, specification grade receptacles. Provide receptacles equal to Hubbell Wiring Devices BR20C2GNTR series. Receptacle color shall be green.

H. Recessed receptacle for wall mounted projectors and clocks: Provide recessed receptacle, 20A rated, tamper-resistant, 2 pole, 3 wire, grounding, with side wire terminations. Provide receptacles equal to Hubbell Wiring Device-Kellems RR201CHSSTR. Verify color selections with Architect.

I. Plugs: 15-amperes, 125-volts, 3-wire, grounding, armored cap plugs, parallel blades with cord clamp, and 0.4 inch cord hole; match NEMA configuration with power source's.

J. Plug Connectors: 15-amperes, 125-volts, bakelite-body armored connectors, 3-wire, grounding, parallel blades, double wipe contact, with cord clamp, and 0.4 inch cord hole, match NEMA configuration to mating plug's. Arrange as indicated.

K. Snap Switches: quiet type AC switches as indicated in Table 2 in Part 3 below. Comply with

UL 20 and NEMA WD1. Where not otherwise indicated, provide 20A industrial/institutional heavy duty grade switches.

1. Standard Toggle: Provide Hubbell Wiring Device-Kellems 122*-I (* - single pole, double pole, three-way and four-way as required) series or approved equal with colors as selected by the Architect.
2. Piloted Toggle: Provide Hubbell Wiring Device-Kellems HBL122*PL (* - single pole, three-way and four-way as required) or approved equal with colors as selected by the Architect.
3. Standard Key: Hubbell Wiring Device-Kellems HBL122*LI with HBL1209 key for locking (* - single pole, double pole, three-way and four-way as required) series or approved equal with colors as selected by the Architect

2.2 WIRING DEVICE ACCESSORIES

A. Wall plates: single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide wall plate color to match wiring devices except as otherwise indicated. Provide wall plates with engraved legend where indicated. Conform to requirements of Section "Electrical Identification." Provide plates possessing the following additional construction features:

1. Material and Finish: 0.04 inch thick, type 302 satin finished stainless steel.
2. Outdoor covers & material for Wet Locations: Cast Aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations." Provide gray while-in-use cover MX2480S by Hubbell Taymac or approved equal for roof locations. All other locations provide clear horizontal Arlington DBH*1C. Coordinate mounting types with GC.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES AND ACCESSORIES:

A. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other Work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other Work.

C. Install wiring devices only in electrical boxes which are clean; free from building materials, dirt, and debris.

D. Install wiring devices after wiring work is completed.

E. Install wall plates after painting work is completed.

F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A. Use properly scaled torque indicating hand

tool.

3.2 PROTECTION

A. Protect installed components from damage. Replace damaged items prior to final acceptance.

3.3 FIELD QUALITY CONTROL

A. Testing: Prior to energizing circuits, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six times.

B. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

END OF SECTION 262726

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:

1. Feeder and branch-circuit protection.
2. Motor and equipment disconnecting means.

B. Related Sections include the following:

1. Division 26 Section "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. RMS: Root mean square.

C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each switch and circuit breaker.

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Current and voltage ratings.
c. Short-circuit current rating.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.

D. Field Test Reports: Submit written test reports and include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 01. In addition to requirements specified in Division 01 Section "Closeout Procedures," include the following:

1. Routine maintenance requirements for components.
2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
3. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA AB 1 and NEMA KS 1.

D. Comply with NFPA 70.

E. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2000 m).

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spares: For the following:

a. Potential Transformer Fuses: One for every 10 installed; minimum of 3.
b. Control-Power Fuses: One for every 10 installed; minimum of 3.
c. Fuses and Fusible Devices for Fused Circuit Breakers: One for every 10 installed; minimum of 3.
d. Fuses for Fused Switches: One for every 10 installed; minimum of 3.
e. Fuses for Fused Power-Circuit Devices: One for every 10 installed; minimum of 3.

2. Spare Indicating Lights: Six of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fusible Switches:

a. Eaton Corp.; Cutler-Hammer Products.
b. General Electric Co.; Electrical Distribution & Control Division.
c. Square D Co.

2. Molded-Case Circuit Breakers:

a. Eaton Corp.; Cutler-Hammer Products.
b. General Electric Co.; Electrical Distribution & Control Division.
c. Square D Co.

3. Combination Circuit Breaker and Ground-Fault Trip:

a. Eaton Corp.; Cutler-Hammer Products.
b. General Electric Co.; Electrical Distribution & Control Division.
c. Square D Co.

2.2 ENCLOSED SWITCHES

A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.

B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position.

C. Elevators: Provide (2) NO/NC contacts where indicated and for all disconnects in an elevator machine room.

2.3 ENCLOSED CIRCUIT BREAKERS

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front- mounted, field-adjustable trip setting.
3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
5. Molded-Case Switch: Molded-case circuit breaker without trip units.
6. Shunt-Trip: Integral shunt-trip module within the Molded-case circuit breaker.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.

2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2.5 FACTORY FINISHES

A. Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard grey paint applied to factory-assembled and -tested enclosures before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section “Identification for Electrical Systems."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.4 CONNECTIONS

A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.

B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
2. Test continuity of each line- and load-side circuit.

B. Testing Agency: Engage a qualified independent testing agency to perform specified testing.

C. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.1 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.2 CLEANING

A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262816

SECTION 263213 - ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged engine-generator sets for standby power supply with the following features:

1. Natural Gas engine.
2. Unit-mounted cooling system.
3. Unit-mounted control and monitoring.
4. Remote annunciator.
5. Performance requirements for sensitive loads.
6. Outdoor sound attenuating enclosure.

B. Related Sections include the following:

1. Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.
2. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Design Calculations: Signed and sealed by a qualified professional engineer in the State of New Jersey. Calculate wind loading in accordance with the 2018 IBC considering generator base concrete slab, anchorage to the slab, and generator/sub-base tank/housing.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Qualification Data: For installer and manufacturer.

D. Source quality-control test reports.

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

G. Warranty: Special warranty specified in this Section.

1.1 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Comply with ASME B15.1.

G. Comply with NFPA 37.

H. Comply with NFPA 70.

I. Comply with NFPA 99.

J. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

K. Comply with UL 2200.

L. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

M. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.2 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Refer to Division 26 section “Summary of Work.”

B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 15 to plus 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1000 feet (300 m).

1.3 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor- bolt inserts into bases.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

1.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 24 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Caterpillar.
2. Rehlko (previously Kohler).
3. Cummins Power Generation; Industrial Business Group (Basis of Design)
4. Generac

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set model C150 N6 150kW standby-rated unit as manufactured by Cummins or approved equal by one of the manufacturer’s listed above. Generator max dimensions, including housing: 160” L x 40” W x 72” H. Height can increase.

B. Engine-generator set shall comply with EPA certification level required for the generator size.

C. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

D. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
2. Output Connections: Three-phase, four wire.

3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of components.

E. Generator-Set Performance for Sensitive Loads:

1. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.

   a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.

2. Steady-State Voltage Operational Bandwidth: 0.5 percent of rated output voltage from no load to full load.
3. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.
4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
6. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
7. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
8. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
9. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.

   a. Provide permanent magnet excitation for power source to voltage regulator.

10. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

A. Fuel: Natural Gas

B. Rated Engine Speed: 1800RPM.

C. Lubrication System: The following items are mounted on engine or skid:

1. Lube oil pump: shall be positive displacement, mechanical, full pressure pump.
2. Filter and Strainer: Provided by the engine manufacturer of record to provide adequate filtration for the prime mover to be used.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Engine Fuel System: The engine fuel system shall be installed in strict compliance to the engine manufacturer's instructions

E. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and performance.

1. Designed for operation on a single 120 VAC, Single phase, 60Hz power connection. Heater voltage shall be shown on the project drawings.
2. Installed with isolation valves to isolate the heater for replacement of the element without draining the engine cooling system or significant coolant loss.
3. Provided with a 12VDC thermostat, installed at the engine thermostat housing

F. Governor: Adjustable isochronous, with speed sensing. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate as appropriate to the state of the engine generator. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous states.

G. Cooling System: Closed loop, liquid cooled

1. The generator set manufacturer shall provide prototype test data for the specific hardware proposed demonstrating that the machine will operate at rated standby load in an outdoor ambient condition of 40 deg C.
2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
3. Size of Radiator overflow tank: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
4. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
6. Duct Flange: Generator sets installed indoors shall be provided with a flexible radiator duct adapter flange.

H. Muffler/Silencer: Selected with performance as required to meet sound requirements of the application, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. For generator sets with outdoor enclosures the silencer shall be inside the enclosure.
1. Exhaust pipe on exterior of the enclosure and hinged rain cap shall be schedule 10 stainless steel.

I. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element and restriction indicator.

J. Starting System: 12 or 24V, as recommended by the engine manufacturer; electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Cycle: As required by NFPA 110 for level 1 systems.

3. Battery Cable: Size as recommended by engine manufacturer for cable length as required. Include required interconnecting conductors and connection accessories.
4. Battery Compartment: Factory fabricated of metal with acid-resistant finish.
5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation. The battery charging alternator shall have sufficient capacity to recharge the batteries with all parasitic loads connected within 4 hours after a normal engine starting sequence.
6. Battery Chargers: Unit shall comply with UL 1236, provide fully regulated, constant voltage, current limited, battery charger for each battery bank. It will include the following features:

    a. Operation: Equalizing-charging rate based on generator set manufacturer's recommendations shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 20 deg C to plus 40 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    e. Provide LED indication of general charger condition, including charging, faults, and modes. Provide a LCD display to indicate charge rate and battery voltage. Charger shall provide relay contacts for fault conditions as required by NFPA110.
    f. Enclosure and Mounting: NEMA, Type 1, wall-mounted cabinet.

2.4 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation:
    1. When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.
    2. Provide with generator start circuit integrity monitoring controls between generator and two automatic transfer switches, to comply with NFPA 70-2017.

B. Configuration: Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components shall be grouped in a combination control and power panel. Control and monitoring section of panel shall be isolated from power sections by steel barriers. Panel features shall include the following:

1. Wall-Mounting Cabinet Construction: Rigid, self-supporting steel unit complying with NEMA ICS 6. Power bus shall be copper. Bus, bus supports, control wiring, and temperature rise shall comply with UL 891.
2. Current and Potential Transformers: Instrument accuracy class.
3. Onan PowerCommand 3.3 microprocessor based control operator display panel with (3) auxiliary relays and RS-485 monitoring or approved equal by one of the manufacturers listed above.

C. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Ammeter-voltmeter, phase-selector switch(es).
9. Generator-voltage adjusting rheostat.
10. Fuel tank derangement alarm.
11. Fuel tank high-level shutdown of fuel supply alarm.
12. Generator overload.

D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

E. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals.

F. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.

1. Overcrank shutdown.
2. Coolant low-temperature alarm.
3. Control switch not in auto position.
4. Battery-charger malfunction alarm.
5. Battery low-voltage alarm.

G. Remote Alarm Annunciator: Comply with NFPA 99 and 110. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are flush-mounting type to suit mounting conditions indicated. Connection shall be via RS-485 communications protocol plus 2#12 wiring for 24VDC power.

H. Communications: Modion Gateway to convert to Modbus RS-485.

2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, electronic-trip LSI type; 80 percent rated; complying with UL 489.

1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
2. Trip Settings: Selected to coordinate with generator thermal damage curve.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.
5. Size and Quantity: As per the contract drawings.
6. Shall be selectively coordinate with downstream life safety panel breakers.

2.6 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H

D. Temperature Rise: 105 environment.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Shunt Excitation

G. Enclosure: Drip-proof.

H. Voltage Regulator: SCR type, Separate from exciter, providing performance as specified. The voltage regulation system shall be microprocessor-controlled, full wave rectified, and provide a pulse-width modulated signal to the exciter. No exceptions or deviations to these requirements will be permitted.

I. The alternator shall be provided with anti-condensation heater(s) in all applications where the generator set is provided in an outdoor enclosure, or when the generator set is installed in a coastal or tropical environment.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 15 percent maximum, based on the rating of the engine generator set.

2.7 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Natural rubber.

2. Number of Layers: Two.

2.8 ENCLOSURES

A. Level 2 sound attenuating steel enclosure. 8 position average sound pressure level @ 7 meters from the enclosure shall be 71.3 dB(A).

2.9 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.10 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator with elastomeric isolator pads having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure sets to anchor bolts installed in concrete bases.

D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.

1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints.

E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

F. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. Use Hilti HIT HY-200 epoxy embedment system with a minimum of (8) ¾" galvanized anchors with a minimum embedment of 6".

3.3 CONNECTIONS

A. Connect engine exhaust pipe to engine with flexible connector.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according to Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.

c. Verify acceptance of charge for each element of the battery after discharge.

d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
7. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations, and compare measured levels with required values.
8. Onsite Load Bank Test: Provide 2 hour full 100% load resistive load bank test.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Provide minimum 4 hours of on-site training for the Owner’s personnel.

END OF SECTION 263213

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches: 3-pole or 4-pole, as noted on the drawings.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

C. Qualification Data: For manufacturer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing

Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NEMA ICS 1.

F. Comply with NFPA 70.

G. Comply with NFPA 99.

H. Comply with NFPA 110.

I. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 24 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Contactor Transfer Switches:
   a. ASCO Power Technologies, LP. (Basis of Design).
   b. Caterpillar
   c. Kohler
   d. Cummins

e. Or approved equal

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

2. ATS Switches on this project shall have a minimum withstand rating as follows. Provide required upstream fuses to meet this requirement, as required.
   a. 35,000A RMS for the Life Safety ATS
   b. 35,000A RMS for the Optional Standby ATS

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral: Solid or switched neutral, as noted on the drawings.

H. Neutral Terminal: Fully rated.

I. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 26 Section "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom

entrance of feeder conductors as indicated.

3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

J. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Equal to ASCO 7000 Series automatic transfer switch with solid neutral and microprocessor based transfer control center.

C. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

D. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

G. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.

H. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.

7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Digital LCD screen power manager equal to ASCO Power Manager Xp. Features shall include ability to monitor and display:
    a. Phase-to-Phase Voltages, Phase-to-Neutral Voltages
    b. Phase and Neutral Currents
    c. Frequency
    d. Apparent Power (kVA)
    e. Reactive Power (kVAR)
    f. Real Power (kW)
    g. Power Factor
11. Additional auxiliary contact sets to indicate switch position. Two sets are standard. Specify total number of sets if more are required.
12. Two-pole, double-throw contacts operate when emergency source voltage is present at transfer switch terminals.
13. Two-pole, double-throw contacts operate when normal source voltage is present at transfer switch terminals.
14. Push-to-Test feature on all pilot light indicators.
15. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
16. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
17. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.
18. Load side external surge protection unit rated 100kA per phase with through door rotary disconnect switch.
    a. Provide ASCO 460-277Y-10-T-C-E-1 surge protection device in NEMA 1 enclosure.
19. Generator start circuit integrity monitoring controls, to comply with NFPA 70-2017, equal to ASCO 5101 series.

2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

B. Identify components according to Division 26 Section "Identification for Electrical Systems."

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

D. Connect each ATS to the BMS system to monitor the is on the generator.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.

b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.

5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
b. Simulate loss of phase-to-ground voltage for each phase of normal source.
c. Verify time-delay settings.
d. Verify pickup and dropout voltages by data readout or inspection of control settings.
e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool- down and shutdown.

6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

B. Coordinate tests with tests of generator and run them concurrently.

C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

D. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel for a minimum of 2 hours to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Division 01 Section "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:
1. Materials.
2. Finishes.
3. Luminaire support.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relay panes, and architectural dimming systems and for LED dimming controls with dimming drivers specified in interior lighting Sections.

2. Refer to Lighting Fixture Schedule on Contract Drawings.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, arranged by designation.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.1 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved:

B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

C. Product Certificates: For each type of luminaire.

D. Sample warranty.

1.2 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.3 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Standards:

1. ENERGY STAR certified.
2. California Title 24 compliant.
3. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
4. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
5. UL Listing: Listed for damp location.
6. Recessed luminaires shall comply with NEMA LE 4.

C. CRI of minimum 80. CCT, as noted in Lighting Fixture Schedule.

D. Rated lamp life of 50,000 hours to L70.

E. Lamps dimmable from 100 percent to 10 percent of maximum light output in classrooms and common spaces. Lecture Hall fixture shall be dimmable from 100 percent to 1 percent.

F. Internal driver, unless otherwise noted.

G. Nominal Operating Voltage: As noted in Lighting Fixture Schedule.

1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

2.2 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers, and Globes:

1. [Retain "Acrylic" Subparagraph below if acrylic options in "Diffusers and Globes" Paragraph above are retained.
2. Acrylic: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

2.5 LIGHTING FIXTURE SCHEDULE

A. General: Various fixture types required are indicated below. Fixtures must comply with minimum requirements as stated herein. Review architectural drawings and specifications to

verify ceiling types, modules, suspension systems appropriate to installation. In general, where so noted, substitutions for different type of fixture will be acceptable, based only on the alternate manufacturer listed for the specific fixture type, and on objective criteria as submitted in accordance with Instructions to the Bidders.

B. A contractor submitted shop drawing for the lighting fixtures, stamped as Approved by the contractor, constitutes that the contractor has reviewed, coordinated and approved all information (number and quantity of switching devices, ceiling types, wiring schemes, etc.) on the Electrical and Architectural drawings.

C. Refer to the contract drawings for the lighting fixture schedule.

1. **Model numbers are shown for information only. The written description for each fixture shall supersede the model number. It shall be the contractor's responsibility to verify all model numbers. All final fixture finishes shall be selected by the Architect prior to fixture approval. Contractor shall bid on the most expensive finish available for each fixture, unless otherwise noted.**

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports: Sized and rated for luminaire weight.

E. Flush-Mounted Luminaire Support: Secured to outlet box.

F. Wall-Mounted Luminaire Support:
1. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod, wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.

2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

J. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265119

SECTION 265619 – LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General Conditions, and Division - 1 Specification Section, apply to work of this Section.

B. All the requirements of all the Division 26 Sections apply to this Section.

1.2 SUMMARY:

A. Extent, location, and details of lighting fixture work are indicated on drawings and in schedules.

B. Outdoor lighting control panels, refer to section “Lighting Control Devices.”

C. Types of lighting fixtures in this section include the following:

1. LED

1.3 SUBMITTALS:

A. General: Submit the following in accordance with conditions of Contract and Division 1 Specification Sections.

B. Product Data: Submit manufacturer's product data and installation instructions on each type interior and exterior building lighting fixture and component.

C. Shop Drawings: Submit layout drawings of lighting fixtures and their spatial relationship to each other. In addition, submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in "laminar type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet. Drawings shall indicate complete details of fixture, including manufacturer's catalog numbers for sockets, ballasts, lamps, lightshields, lenses, metal gauges, type of wiring, finish color and texture.

D. Note for Product Data and Shop Drawing submittals: The shop drawings will be immediately rejected if specific ballasts and lamps, as well as the other data indicated above, are not provided.

E. Wiring Diagrams: Submit wiring diagrams for auditorium lighting showing connections to electrical power panels, switches, dimmers, controllers, and feeders. Differentiate between portions of wiring which are manufacturer-installed and portions which are field-installed.

F. A contractor submitted shop drawing for the lighting fixtures, stamped as Approved by the contractor, constitutes that the contractor has reviewed, coordinated and approved all information (number and quantity of switching devices, wiring schemes, etc.) on the Electrical and Architectural drawings.

1.4 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of lighting fixtures of sizes, types and ratings required, whose products have been in satisfactory use in similar

service for not less than 5 years.

B. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Articles 220, 410, and 510 as applicable to installation, and construction of building lighting fixtures.
2. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No.'s LE 1 and LE 2 pertaining to lighting equipment.
3. IES Compliance.
4. UL Compliance: Comply with UL standards, including UL 486A and B, pertaining to lighting fixtures. Provide lighting fixtures and components which are UL-listed and labeled.
5. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.1 WARRANTY

A. The contractor shall warrant the completed lighting system wiring, equipment, lamps and ballasts to be free from inherent mechanical and electrical defects for a period of 2 years from the date of Substantial Completion. Refer to Division 1 specifications for definition of Substantial Completion.

B. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

C. Warranty Period: 5 years from date of Substantial Completion.

D. Contractors shall note that all equipment warranties, as described in the various sections of the Specifications, will begin after Substantial Completion. It will not make any difference when equipment is ordered, delivered or installed, warranties will commence after the Architect issues his letter of “Substantial Completion.”

1.2 DELIVERY, STORAGE, AND HANDLING:

A. Deliver lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from damage.

B. Store lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground.

C. Handle lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.3 SEQUENCING AND SCHEDULING:

A. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of lighting fixtures with other work.

B. Sequence lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

1.4 GENERAL

A. Furnish lighting fixtures, lighting equipment components, branch circuiting and lamps for a complete lighting system. All incandescent fixtures shall be prewired type.

B. The driver and all other parts shall be considered as components of the fixture, and it shall be the responsibility of the manufacturer of the fixture to furnish labor and material required to repair or replace any or all of the components that become defective during the guarantee period stated in this specification.

C. Location of fixtures on drawings is diagrammatic. Verify locations with site plans, or other reference data for final location and spacing in advance of installation. Examine space conditions and requirements for installation of fixtures. Coordinate installation of fixtures with other trades to avoid interferences.

D. Wiring channels and socket mountings shall be rigid and accurately made. Sockets shall hold lamps securely against normal vibration and maintenance handling. Socket contacts shall be silver plated. For rapid start lamps on single ballasts, furnish one grounding socket.

E. Provide approved support for each lighting fixture outlet.

F. Blemished, damaged, or unsatisfactory fixtures shall be replaced at the direction of the Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or alternatives of the quality necessary to meet the specifications. Manufacturer for each type of fixture are indicated in the fixture schedule.

2.2 FIXTURES:

A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy- efficient lamps, lamp holders, reflectors, energy efficient ballasts, starters and wiring. Ship fixtures factory-assembled, with those components required for a complete installation. Design fixtures with concealed hinges and catches, with metal parts grounded as common unit, and so constructed as to dampen ballast generated noise. All High Intensity Discharge fixtures shall be equipped with high impact glass lenses.

B. Refer to Section 265119 for luminaire requirements on this project.

C. Refer to the contract drawings for the lighting fixture schedule.
   1. **Model numbers are shown for information only. The written description for each fixture shall supersede the model number. It shall be the contractor's responsibility to verify all model numbers. All final fixture finishes shall be selected by the Architect prior to fixture approval. Contractor shall bid on the most expensive finish available for each fixture, unless otherwise noted.**

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures. Notify Architect in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF EXTERIOR LIGHTING FIXTURES:

A. Install exterior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.

C. Fasten electrical lighting fixtures and brackets securely to indicated structural supports, including poles/standards; and ensure that installed fixtures are plum and level.

D. The Electrical Contractor will furnish and install photocells to control the outdoor lighting circuits.

3.3 FIELD QUALITY CONTROL:

A. Replace defective and burned out lamps for a period of one year following the Date of Substantial Completion.

3.4 ADJUSTING AND CLEANING:

A. Clean lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses.

B. Protect installed fixtures from damage during remainder of construction period.

3.5 GROUNDING:

A. Provide equipment grounding connections for interior and exterior lighting fixtures as required. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

B. Refer also to section Grounding.

END OF SECTION 265619

SECTION 271000 - INFORMATION TECHNOLOGY CABLE PLANT

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the provision of voice and data telecommunication system cabling related work indicated on the contract drawings and specified in this Section.

B. Work includes, but is not necessarily limited to, the following:

1. Backboxes, conduit, conduit sleeves, cable trays and wiring devices for the voice, data and DAS systems and fiber backbone and work indicated on the contract drawings.
2. All conduit shall be concealed in occupied spaces except where specifically allowed.
3. Provision of CAT 6A plenum cable, single mode fiber optic backbone cable, patch panels, patch cords, equipment racks voice-data receptacle plates, cable trays and all other equipment and work indicated on the contract drawings.
4. Provide labor, materials, equipment, services, and operations required for the installation of complete and operational telecommunication cable plant as indicated on the drawings and/or specified herein.
5. The work shall include all materials and labor required for the installation of a complete and operational system that complies with all EIA/TIA guidelines, standards, and applicable codes.
6. Labeled voice-data faceplates, RJ45 jack modules, labeled patch panels, copper and fiber patch cords, workstation patch cables, grounding bar at each IT rack. See Part 2 for additional information.
7. Equipment racks shall be provided with all required termination equipment, wire management products.
8. Grounding system shall be provided in accordance with ANSI/TIA/EIA-607 for technology equipment in each rack location.
9. Verification of dimensions and conditions at the job site prior to equipment installation.
10. Coordination with associated trades.
11. Certification of wire performance.
12. See contract drawings for more information.

C. Any additional materials or services needed in order to meet the general requirements stated above, even if not specifically mentioned herein or on the drawings, shall be provided by the Contractor without claim for additional payment.

1.3 RELATED SECTIONS

A. General provisions for Electrical work - applicable sections of Division 260000

B. Section 260528 Audio-Visual System Infrastructure.

1.4 QUALITY ASSURANCE

A. Work shall be done by persons skilled in this trade in strict accordance with the requirements and/or specifications of the manufacturers of the material being used. Vendor must provide named references / contacts from three or more clients where vendor has installed cable in a new construction building of at least 20,000 sq. ft. References, complete with contact information, must be submitted during bid submission.

B. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure steady progress of all work under Contract.

C. All electrical equipment and materials shall have the listing of the Underwriters' Laboratories, Inc., and shall bear the labels attesting to UL listing, and types approved by the Municipal Departments having jurisdiction.

D. Additional Reference Standards:

1. Published specifications, standards, tests, or recommended methods of trade, industry or governmental organizations apply to work in all sections as notes below:
   a. OSHA - Occupational Safety and Health Administration Regulations.
   b. NEMA - National Electrical Manufacturers Association
   c. UL - Underwriter's Laboratories
   d. NFPA - National Fire Protection Association
   e. ANSI – American National Standards Institute
   f. CCIA – Computer Communications Industry Association
   g. EIA - Electronics Industries Alliance
   h. FCC - Federal Communications Commission
   i. ITU - International Telecommunications Union
   j. NEC - National Electric Code
   k. Building Infrastructure Consulting Service International (BICSI) Telecommunication Methods Manual, 10th Edition and Information Transportation Systems Installation Manual, 4th Edition
   l. TIA – Telecommunications Industry Association
      1) TIA/EIA 526-7 Measurement of Optical Power Loss of Installed Single Mode Fiber Cable Plant Standard 1998
      2) TIA/EIA 526-14A Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant Standard 1998
      3) TIA/EIA 568-B.1 Commercial Building Telecommunications Cabling Standard General Requirements 2001
      4) TIA/EIA TSB67 Transmission Performance Specifications for Field Testing of Unshielded Pair Cabling Systems.
      5) TIA/EIA 606A Administration Standard for Commercial Telecommunication Infrastructure 2002.
      6) J-STD-607-A Commercial Building Grounding and Bonding Requirements for Telecommunication Standard 2002

E. This contractor shall be an authorized representative of the Siemon of the major equipment items specified including but not limited to patch panels, cable and all other major components of the system equipment specified herein.

F. This Contractor shall have successfully provided installation and engineering services over completed installations for a period of three years or more and shall have completed at least five major system installations of this type. IRT shall be the final judge of suitability of

experience.

G. The project has the following specific Installation Requirements for the work of this section. The low voltage cable Installation includes all work related to installing low voltage or fiber optic cable. Provide specific information and data, to show compliance with each of the following requirements.

1. Installation in accordance with Siemon Certified Installer protocol to maintain campus- wide 30-year warranty. Specifically, 30% of installation technicians must be certified on fiber and copper installation. Proof of certification or equal certification must be provided to the Construction Manager, Architect, and Owner prior to commencement of installation work.
2. Installation must be overseen by a project manager that has been certified by Siemon in order to maintain the Rowan University campus-wide 30-year warranty. Proof of certification must be provided to the Construction Manager and Owner prior to commencement of installation work or equal.

H. Installer must have at least two certified Registered Communications Distribution Designers (RCDD) on permanent, full-time staff to maintain campus-wide 30-year warranty. Proof of Certification must be provided to the Construction Manager and Owner prior to commencement of installation work.

1.5 DEFINITION OF TERMS

A. The term Electrical Contractor / Telecommunication Contractor as used herein refers to the party responsible for supplying all materials and services specified herein and indicated on related drawings.

B. The term “This Contractor” or “Communication Contractor” (CC) or Telecom Contractor (TC) as used herein refers to the party responsible for providing telecommunication equipment and services specified herein.

C. The term “provide” shall mean to supply and install.

1.6 JOB CONDITIONS

A. Investigate the nature and location of the Work, the general and local conditions, particularly those bearing upon the Work required such as: transportation, disposal, handling and storage of materials, availability of labor, electric power and physical conditions at the site and character of equipment and facilities needed during the execution of the Work. Obtain all information that can affect the Work, or cost thereof under the Contract.

B. The Contractor shall coordinate shop drawings well in advance with other trades. It is the Contractors sole responsibility to obtain all necessary information from other trades.

1.7 SUBMITTALS

A. Shop drawings and samples shall be submitted in accordance with the requirements established in the General Conditions or specified elsewhere and shall in addition include at minimum the following:

1. Plan, elevation, section as required to fully illustrate all power, telephone, voice, data, fire alarm, outlets, including all system wiring devices such as pull boxes, conduit in slab, stub-up locations, outlet boxes, cable trays indicated on the IT, AV and Electrical drawings including conduit and cable routing (1/4" = 1'-0" min.)
2. The Contractor shall coordinate shop drawings well in advance with other trades. It is the Contractors sole responsibility to obtain all necessary information from other trades.

2. Plans to include nomenclature for face plate receptacle ID numbers.
3. Detail layout of equipment in IDF closets including rack elevations, plan layout, grounding detail, etc.
4. Provide color coded plans to of items described above in paragraph #1.
5. Submit manufacturer's product data sheet on each component to the Information Technology Cable Plant including but not limited to:
   a. Sample and product data of each cable type to be used, patch panel, face plate, RJ45 receptacle, cable and receptacle type used in the system.
   b. Typical back box for mounted in concrete (2 gang with 1 gang extension and cover plate).
6. Typical back box for mounted in in gypsum wall board (2 gang with 1 gang extension and cover plate). Pull Schedules that shall include cable ID, cable length, Patch Panel Termination Frame ID, Port/Position number, Cabinet ID, Riser ID.

B. The following samples shall be provided to the Architect and IRT for review prior to installation:

1. Specified cover plates with jack modules for wall, ceiling and floor box locations. Sample shall include proposed jack identification. Note – face plates for visible wall or ceiling mounted location to be custom finish and color.
2. Cable labels.
3. Cable dressing materials.
4. Wire management hardware such as J-Hooks, cable ties, etc.
5. Patch panel with labeling and cable dressing.
6. Each floor box type with specified cover plate installed.

C. As-Built drawings.

1. During the progress of the work, Contractor shall make a careful record of all changes by which the actual installation differs from that indicated on the Bid Documents. Upon completion of work, Contractor shall compile a complete set of the design drawings with all changes incorporated electronically. Visibly indicate changes and deviations from scope with "clouds" or similar technique for identifying changes to the drawings.
2. Prior to contract closeout, submit two (2) hard copy of the system record drawings and documents to Owner and Architect. The drawings shall be "D" size and laminated. The laminated shall be permanent attached in the MDF and IDF(s). The Contractor will be required to make any requested changes to documents before a final approval and acceptance is issued.
3. Upon approval from the Architect and Owner, submit two (2) hard copies of the "as-built" drawings to the Owner in accordance with the General Conditions. In addition, provide electronic files of all record drawings in AutoCAD 2018 format and PDF.
4. The "as-built" drawings shall include all ladder rack and basket tray routing, cable routing, outlet and cable labeling, telecommunication room layouts and equipment elevations.
5. Cable pull schedules shall be updated as necessary and submitted with the drawings.

D. Test Results:

1. Prior to systems acceptance and commissioning, submit system-testing documentation showing methods and results for all tests performed.
2. If certain equipment is determined to be exempt from system testing, the Contractor shall state that the equipment was not tested (in written form), and provide specific reasons for the exclusion of test results for said equipment, cabling, or system.
3. Electronic cable tests must be submitted to Architect for review in a PDF format. Subsequent field changes may be required to remedy poor test

results.

4. This Contractor will submit the test results (30) thirty days prior to Substantial Completion to allow for field changes prior to the expected move-in date.

1.8 DELIVERY, STORAGE AND HANDLING

A. Protect product from damage. Comply with all manufacturers' recommendation for handling, storage and protection.

1.9 WARRANTY

A. For the duration of installation and warranty period, service calls must be responded to within two hours of request, by arrival of technicians and equipment to project site.

B. Project will be required to receive Siemon A thirty (30) year premium Siemon Cabling System® Z-MAX®, warranty covering products, performance and applications assurance for cabling systems designed and installed by Siemon Certified Installers in a registered cabling system using Siemon connecting hardware and qualified cable.

1.10 PUBLICATION

A. Written approval from the Owner shall be obtained prior to the release of any information concerning this project.

PART 2 - PRODUCTS

2.1 DESCRIPTION OF SYSTEMS

A. Provide all raceways, back boxes, pull boxes, sleeves, and floor boxes indicated in the documents for interconnection among and between the devices comprising the systems indicated in Part 1 above.

B. All raceways and related equipment shall be provided as per applicable sections of electrical specifications, the Drawings and in accordance with the National Electrical Code and local codes having jurisdiction.

C. See electrical drawings and specifications for additional requirements.

2.2 GENERAL REQUIREMENTS

A. All materials and components shall be new and of manufacturer's finest quality as appropriate to the application.

B. Uniform materials and components shall be used throughout, and wherever possible, shall be field replaceable and commonly available.

C. All materials shall conform to applicable UL standards and to general electrical requirements unless specifically accepted by requirements of this section.

D. See applicable sections of Division 26 for more information.

2.3 DUCTS

A. General Requirements.

1. All floor boxes shall be UL listed for scrub water and all other code requirements.
2. Floor boxes shall be modified where necessary to accommodate specified conduit size and quantities.
3. Conduits shall be routed to appropriate side of box accommodating services as

described below.

4. See AV Drawings for floor box details.
5. For cast in concrete boxes, particular attention shall be paid to setting the proper elevation of the box to accommodate floor finishes. Refer to architectural drawings for more information. Any adjustments required to create a perfectly smooth transition from adjacent finish floor materials to box cover shall be the responsibility of this contractor.
5. For all cast in place boxes with occupied spaces below, provide fire separation material below to maintain fire rating.
6. Routing of conduits in slab and above finish ceilings shall be coordinated with structural requirements.
7. Refer Architectural drawings for information regarding ceilings that no space for conduit above the finish ceiling. In these areas, conduit must be embedded in concrete.

B. Flush Floor Box

1. Floor boxes shown on the contract drawings are multi-service.
2. Refer to Symbol List on Dwg E-002 for information regarding basis of design floor boxes and accessories.

C. DAS Antenna and Splitter NEMA 1 Boxes

1. Pull boxes shall be in accordance with NEMA/EEMAC Type 1, UL 50 Type 1 and IEC 529, IP30.
2. Box shall be fabricated from 14 gauge steel.
3. Box shall be provided with screw cover plates for flush mounting.
4. Knockouts for conduits shall be as required to meet conduit sizes indicated on plans.
5. Box and screw cover shall be finished with dark gray enamel inside and out.
6. Acceptable Manufacturers:
   a. Size to be 24” x 24” x 6”
      Type 1 Bulletin A90P1 Screw Cover Pull Boxes by Hoffman
   b. Or Approved Equal.

D. Electrical Work Embedded In Concrete

1. Provide suitable PVC rigid conduit, pull boxes for conduit and fitting for conduit paths to be encased in concrete.
2. Penetration of fire rated walls, floors or ceilings shall use classified Through-Penetration Firestop Systems described in the current Underwriters Laboratories Fire Resistance Directory.
3. Fittings, accessories and outlet boxes shall be designed for use with selected conduit. All components shall be listed by Underwriters Laboratories and shall be from one manufacturer.
4. Unless indicated differently on drawings, conduit systems shall be color coded: BLUE for low voltage power, YELLOW for other low voltage communications, For PVC conduit, conduit shall be painted in similar color schedule at each end or at pull box locations.

E. Electrical Work Not Embedded in Concrete

1. Provide suitable EMT conduit, pull boxes for conduit and fitting for conduit paths not encased in concrete.
2. Penetration of fire rated walls, floors or ceilings shall use classified Through-Penetration Firestop Systems described in the current Underwriters Laboratories Fire Resistance Directory.

3. Fittings, accessories and outlet boxes shall be designed for use with selected conduit. All components shall be listed by Underwriters Laboratories and shall be from one manufacturer.
4. Unless indicated differently on drawings, conduit systems shall be color coded: BLUE for low voltage power, YELLOW for other low voltage communications, For EMT conduit, conduit shall be painted in similar color schedule at each end.
5. Receptacle boxes, where located on the drawings for IT raceway system, shall be in accordance with NEMA/EEMAC, UL 50 Type 1 and IEC 529, IP30.
6. Boxes shall be fabricated from 16 gauge or 14 gauge steel. All boxes shall be provided with cover plates for flush mounting except where otherwise noted. Knockouts for conduits shall be as required to meet conduit sizes indicated on plans.
7. Ceiling box at the video projector location shall be mounted adjacent to the video projector power outlet.
8. Typical recessed device backbox shall be (2) gang, 2-1/8" deep with (1) gang reducer to accept one gang finish plate. For surface mounted conditions, the backbox shall be 1 gang.
9. Provide knock-out for 1-1/4" EMT conduit stub-up to nearest cable tray or accessible ceiling where provided. If there is no accessible ceiling, extend conduit to the termination rack in the IT room or to pull boxes in storage rooms, janitors closet, toilet rooms.
10. Acceptable Manufacturers:
    a. Midland Ross, Leviton, Steel City, Hubbell, or Approved Equal for EMT conduit
    b. Thomas and Betts, Allied, Carlon Sales or Approved Equal for ENT conduit.
    c. See electrical specification for additional manufacturers.

F. Conduit Sleeves

1. Conduit sleeves where indicated on the contract drawings shall be installed in accordance with applicable sections of the electrical specifications and as described herein.
2. Conduit sleeves shall be provided with insulated bushings at each end.
3. Sleeves without exception shall be treated to create an airtight condition. Where sleeves pass through a fire rated partition or floor, fire stops~~firestop~~ all penetrations to be code compliant.
4. Exact size of conduit sleeves will be as required to have a maximum of 60% cable fill. Verify the exact~~Verify exact~~ location of all sleeves with the Architectural drawings.
5. Acceptable Manufacturer:
    a. Series 33 by STI Firestop
    b. Or Approved Equal

2.4 STRUCTURED CABLING CABLE

A. Pair Category 6A UTP Cable

1. Cable shall be 100-Ohm, 4-pair unshielded twisted pair cable with 24 AWG solid copper conductors.
2. Cable shall be plenum rated.
3. Cable shall meet or exceed all performance characteristics specified in the ANSI/TIA/EIA- 568-B-2.1 Draft 10 standard for Category 6A cable.
4. all support 1000BASE-T, 1000BASE-TX, and all current applications designed to be supported by Category 6A.

5. Cable shall be Siemon P/N 9C6P4A505AR1ARU or approved equal with yellow jacketing labeled with “Rowan University” and the production date; to be compatible with University-wide standards.

B. Copper Patch Cords

1. Cords shall consist of 4-pairs of 24 AWG stranded copper conductors.
2. 8-position~~8-posititon~~ modular plugs (RJ-45 type).
3. 100% transmission tested with laboratory grade network analyzers for proper performance up to 500 MHz. Vendors~~Vendor~~ shall guarantee cords are compatible with Category 6A channels.
4. VERIFIED (or equivalent) for TIA/EIA Category 6A electrical performance.
5. provide a quantity of patch cords to patch the work area, MDF and IDF rooms terminations.
6. Patch cords shall be ordered in lengths that will leave no more than 18 inches of slack in any single patch, based on telecommunication room equipment layout.
7. Provide labor and materials to perform patches based on the number of ports installed to Owner furnished network electronics.
8. Cable shall be Category 6A, color blue, by Siemon.

C. Single Mode~~Singlemode~~ Fiber Optic Cable

1. Cable shall be 50-micron singlemode (OS2) fiber optic cable.
2. Cable shall be plenum rated (NEC Classification: OFNP)
3. Cable shall meet or exceed all performance characteristics specified in the ANSI/TIA/EIA- 568-B.03 standard for singlemode fiber optic cables.
4. Attenuation change vs wavelength 1285 to 1330 nm.
5. Maximum Dispersion at 1310/1550 nm ≤ 3.2/18.0 ps/nm x km
6. Strand quantities shall be as indicated on drawings.
7. Singlemode fiber optic cabling shall be an armored cable with yellow jacket.
8. Provide labor and materials to perform fiber patch cord connections to each Owner furnished network switches. Exact length to be determined. For bid purposes average length to be 10’-0”
9. Cable shall be by Siemon or approved equal.

2.5 STRUCTURED CABLING TERMINATION HARDWARE

A. 48-Port Category 6A UTP Patch Panel

1. Patch panels shall be used for terminations of horizontal voice, data and wireless access point cables in IT racks were~~where~~ called for on the drawings.
2. Provide sufficient quantities to terminate each voice, data and wireless access point cable indicated on drawings.
3. Provide separate patch panel for Wireless Access point cabling, wiring to video projectors and AV racks.
3. Patch panels shall be modular to 110-type patch panels, complete with Category 6A T568B RJ45 jacks.
4. Patch panels shall be high density, 19-inch rack mountable and one (1) rack units high.
5. Provide one (2) rack unit cable management panel for each patch panel provided.
6. Patch panels shall be Siemon Z6A-PNL-U48K.

B. Fiber Optic Connect Panel

1. Terminate fiber optic riser cable in IT racks werewhere called for on the drawings.
2. shall be 3 RU high and provided with fiber adapter panels with LC connectors for

each strand of fiber cable.
3. Rack-mountable in standard 19-inch EIA racks.
4. Fiber enclosure shall be RIC3-72-01by Siemon. IDF Fiber enclosure shall be RIC3-24-01 Siemon or approved equal.
5. Fiber adapters shall have 24 strand LC connectors and shall be RIC-F-L(X)Q24-01C by Siemon.

2.6 STRUCTURED CABLING WORK AREA TERMINATION HARDWARE

A. Voice-data outlet faceplates

1. Faceplates shall be installed at all wall mounted outlet locations to accommodate termination modules and connectors for horizontal cabling.
2. See drawings for quantities, locations and configurations.
3. Single gang faceplate.
4. Outlet faceplate shall be manufactures standard color. Provide blanks for ports not used.
5. IT plates for floor boxes can be standard white.
6. All visible voice-data locations, unless noted otherwise, shall be provided with the exact same faceplate.

B. Wall Phone Faceplates

1. Faceplate shall be used at all wall phone locations to terminate horizontal cable and mount phone.
2. See drawings for quantities, locations and configurations.
3. Faceplate shall have mounting studs for telephone.
4. Faceplate shall be arctic white with a single RJ45 port in white.

C. Category 6A RJ45 Jacks

1. Shall be used for termination of horizontal voice cabling at work area outlet.
2. EIA/TIA 568B termination.
3. Color: White

D. Faceplate Labels

1. Shall be used to label all outlets.
2. Color: White
3. Labels shall be generated on Brother P-Touch.
4. Faceplate numbering method shall be in accordance with Owner’s standards.
5. Submit sample for review

2.7 STRUCTURED CABLING SUPPORT EQUIPMENT

A. Cable Termination Equipment Racks for MDF and IDF closets:

1. Rack shall be used for mounting of patch panels, wire management and network switches.
2. Rack shall be 45 rack units and 19-inch mountable with standard EIA hole spacing.
3. Racks shall be bolted to slab at front and rear flanges and tied to overhead ladder rack for additional stability with treaded rod and steel channels from Unistrut or Kindorf.
4. Racks shall be grounded by a #6 AWG wire with green insulation to ground bus bar. Use lug type connectors at each end.
5. Racks shall be provided with equipment mounting screws (50 per rack minimum).
6. Each rack shall be provided with double sided vertical cable management such as Chatsworth #14831-703.
7. Provide 6" wide vertical cable management accessory.
8. Approved Cable Termination Rack:
   a. Chatsworth 46353-703 (black)
   b. Or Approved Equal

B. Cable Tray

1. In IT closets, provide cable tray and all required fittings, transition members, junction and butt splice kits, radius bend members, protective end caps, end closing hardware, support brackets and attachment hardware for cable tray where indicated on the drawings.
2. Cable tray shall be UL listed and fabricated from wire mesh shall be nominally 2” high by 18” wide or per width called out on the drawings.
3. Cable tray shall be grounded to copper bus bar.
4. Acceptable Manufacturer:

   a. Cablofil CF54/450 EZ
   b. Or Approved Equal.

C. Ladder Rack

1. Provide vertical ladder racks and all required fittings, floor mounts, support brackets and attachment hardware of ladder rack to wall in each IT closet for transitions from floor or ceiling conduits that stub up from slabs.
2. Ladder rack shall be UL listed and fabricated from aluminum shall be nominally 2” high by 18” wide or per width called out on the drawings.
3. Provide grounding of ladder if required by code.
4. Acceptable Manufacturer:
   a. Cablofil PW Series
   b. Or Approved Equal.

D. Cable Management Straps

1. Cable straps shall be installed to support horizontal cabling.
2. Spacing between straps shall not exceed five (5) feet.
3. Cables must be neatly bundled and tied at each strap and at the midpoint of each span between straps.
4. Safe-T-Grip cable support straps by Chatsworth or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine all work prepared by others to receive work of this Section and report any defects affecting installation to the Architect for correction.

B. Commencement of work will be construed as complete acceptance of preparatory work by others.

C. All devices shall be installed as per applicable sections of Division 26 and in accordance with the National Electrical Code.

D. All conduits shall be concealed in occupied spaces.

3.2 GENERAL REQUIREMENTS

A. Contract Drawings are diagrammatic and indicate general arrangement of systems and work included. Verify exact location of all electrical devices with architectural drawings. If a dimension is not indicated on either the architectural or IT drawings, request in writing, required information prior to proceeding. Any work installed without written direction that is not specifically indicated on the drawings may be rejected and relocated at Contractor expense. All finish or other work by others damaged by relocation of any electrical device shall be the responsibility of the Contractor.

B. Final location of all equipment shall be located as shown on Contractor's reviewed Shop Drawings, or as located in the field by the Architect, or as shown on supplementary drawings prepared by the Consultant. Check drawings of other trades relating to work to verify spaces in which work will be installed. In centering outlets and locating boxes allow for overhead pipes, ducts and mechanical equipment, variations in fireproofing and plastering, window and door trim, paneling, hung ceilings, and the like, and correct any inaccuracy resulting from failure to do so without expense.

3.3 RACEWAYS

A. General Requirements for Electrical Work

1. No exposed raceways shall be permitted except in rooms with no hung or finished ceiling.
2. Pull no wire, insert no fish wire, until raceway and outlet boxes are permanently in place.
3. Provide cable supports for wire in riser conduits as required by code, if applicable.
4. Provide pull boxes in horizontal conduit running every 100 feet as indicated or wherever necessary to facilitate pulling in of wire. Coordinate locations with other trades to provide access.
5. Flexible conduit shall not be permitted.
6. All conduit penetrations through acoustically rated partitions shall be a maximum of 1/2" larger than the penetrating conduit and shall be thoroughly caulked with acoustical non- setting caulk.
7. Provide drag lines with conduit destination noted on drag line to facilitate pulling of cable.

B. Raceway Grounding & Isolation

1. Signal conduits shall be mechanically and electrically connected to receptacle boxes and shall be electrically isolated from system equipment racks. Connect all signal conduits with heavy insulated ground wire to the ground of the nearest ground of a utility panel.
2. Provide terminals of conduits with lock nut and insulated bushing for connection to pull boxes servicing more than one conduit subsystem as described in the

separation Guide Identification table below.

3.4 STRUCTURED CABLE PLANT INSTALLATION

A. Cable Installation:

1. General:

a. All cables, regardless of length, shall be marked with wrap-around typed number or letter cable markers at both ends. There shall not be any unmarked cable at any location. Cable numbers shall correspond to the workstation termination label.
b. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer. As a guideline, the typical minimum bend radius for copper cable is four (4) times the outside diameter of the cable. The typical minimum bend radius for fiber optic cable is ten (10) times the outside diameter of the cable.
c. The maximum cable pulling tensions shall not exceed manufacturer's specifications.
d. Cables shall not contain splices, unless specifically required for performance of the system.
e. All cable terminations involving F-type, RJ45, and other connectors, shall be firmly crimped. "Screw-on" connectors and other similar connector types are considered unreliable and shall not be used for this project.

2. Cable Pathways:

a. Grounding and bonding of pathways shall comply with EIA/TIA 607 grounding standards and applicable codes and regulations.
b. Pathways shall not have exposed sharp edges that may encounter telecommunications cables.
c. The number of cables placed in a pathway shall not exceed manufacturer specifications or distort the geometric shape of any cables within.
d. Maximum pathway capacity shall not exceed a 40% fill.
e. Pathways shall not be located in elevator shafts.
f. All horizontal cables, regardless of media type, shall not exceed 90-meters (295 ft) from the telecommunications outlets in the work area to the horizontal cross connect location. No cable run shall be terminated and tested at a length beyond 90-meters.
g. Telecommunications pathways, spaces, and metallic cables, which run parallel with electric power or lighting that is less than or equal to 480 Vrms, shall be installed with a minimum clearance of 12 inches.

3. Cable Supports:

a. All cable supports in an open ceiling shall be structurally independent of the suspended ceiling, its framework, and supports. Cable supports shall be spaced no more than 5-feet apart.
b. Cables routed in a suspended ceiling shall not be draped across the ceiling tiles. Cable supports shall be mounted a minimum of 3-inches above the ceiling grid supporting the tiles.
c. Contractor shall observe the manufacturer's recommended bending radius and pulling strength requirements of all cables during handling and installation.

d. In the IDF rooms or chases where cable ladder racks are used, Contractor shall provide Velcro cable ties to create a neat appearance.

4. Cable Slack:

a. In the work area, a minimum of 12 inches of cable should be coiled up in the electrical back box so the faceplate and jacks can be serviced, if necessary. Additionally, a minimum of 3 feet of cable slack shall be coiled above the ceiling to re-position the outlet, if necessary.
b. In the telecommunications rooms a minimum of six (6) feet of slack should be left for all cable types. This slack must be neatly managed on trays or other support types above the ceiling.
c. Provide ample cable slack to allow for servicing equipment racks that are located against a wall or other permanent interfering surface. Create an umbilical cord, or similar method of containing the cables.

5. Cable Tie-Wraps:

a. Velcro tie-wraps shall be used at appropriate intervals to secure cable and to provide strain relief at termination points. These wraps shall not be over- tightened to the point of deforming or crimping the cable sheath.
b. Hook and loop cable managers (Velcro or similar) should be used in the telecommunications rooms where reconfiguration of cables and terminations may be frequent.

6. Fire protection:

a. Properly installed firestop systems shall be implemented to prevent or retard the spread of fire, smoke, water, and gases through the building. This requirement applies to openings designed for telecommunications or low-voltage cable use that may or may not be penetrated by cables, wires, or raceways.
b. Fire stops shall be installed according to local building code requirements and NFPA.

C. Equipment Installation:

1. Installation shall include the delivery, unloading, setting in place, fastening to walls, floors, ceilings, counters, or other structures where required, interconnecting wiring of the system components, equipment alignment and adjustments, and all other work whether or not expressly required herein which is necessary to result in complete operational systems.
2. Fastenings and supports shall be adequate to support their weight loads with a safety factor of at least five (5)
3. In the installation of equipment and cable, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.
4. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise.
5. All equipment shall be secured plumb and square.

D. Grounding Procedures:

1. The following grounding procedures shall be followed:

a. All grounding conductors in that area shall connect to this primary system

ground. The system ground shall be provided in the equipment rack for the area. It shall consist of a copper bar of sufficient size to accommodate all

secondary ground conductors.

b. A copper conductor (No. 4 AWG solid conductor wire, with green insulation, having a maximum of 0.1-Ohms total resistance) shall connect the primary system ground bar. The Contractor shall be responsible for determining if the metallic conduit is electrically bonded properly to the building ground system.

c. Secondary system grounding conductors (No. 6 AWG solid conductor wire, with green insulation, with lug attached to rack/cabinet and corresponding ground bar) shall be provided from all racks, cabinets, consoles, cable trays, ladder racks, related conduit, and ungrounded equipment in each area, to the primary system grounding point for the area. Each of these grounding conductors shall have a maximum of 0.1-Ohms total resistance.

d. It is acceptable practice to extend a single conductor to adjacent equipment racks in a row, providing one lug at each rack. However, no ground conductor splices at any point between the grounding point and the lug installed at the rack farthest from the grounding point shall be permitted.

e. Under no conditions shall the AC neutral conductor be used for a system ground, either in the power panel or in a receptacle outlet.

f. Because of the great number of possible variations in grounding systems, it shall be the responsibility of the Contractor to follow good engineering practice, as outlined above, and to deviate from these practices only when necessary to minimize crosstalk and to maximize signal-to-noise ratios in the system.

g. All grounding and bonding shall comply with EIA/TIA 607 grounding standards and applicable codes and regulations.

3.5 QUALITY CONTROL AND COPPER CABLE TESTING

A. Quality Control

1. Contractor to procure only new cable and equipment for this project.
2. Contractor to ensure that all equipment and cable are free of defects and are protected under respective manufacturer warranties.

B. Copper Cable Testing:

1. All pre-fabricated cables shall be factory tested for continuity before shipment. Contractor shall submit documentation to prove the cables have been tested by the manufacturer to industry standards.
2. Contractor shall provide a thorough testing program for the communications cabling plant including final acceptance testing. Contractor shall provide procedures, a list of test equipment and operating instructions before the tests.
3. Subsystems shall be tested individually before testing for end-to-end connectivity. All faults shall be corrected and retested. All test results shall be completely documented by Contractor.
4. For all cable that fails manufacturer's or specified testing criteria, the contractor shall correct the problem or replace the cable or defective component at no additional expense to the Owner.
5. Contractor shall provide two (2) hard copies and one (1) electronic copy (Microsoft Excel or PDF format) of a summary of results for all cables and equipment tested, including: cable ID, strand ID (for fiber optic cables), cable length, and pass/fail result.

6. All test results shall be submitted in a sequential, organized fashion, as per the Specification and/or project schedule.

7. The Owner reserves the right to independently test any or all of the cable plant. If more than 3% of the tested cable plant within a floor, system or area fails, the Contractor will be required to take the following actions at no additional cost.
   a. Reimburse Owner for all costs incurred for independent testing.
   b. Work overtime to remedy defects and retest entire floor, system, or area, as defined by Owner. This corrective work shall not impact the planned occupancy dates.

C. Test Process:

1. Owner reserves the right to be present during any or all of testing.
2. Testing shall be of the Permanent Link. However, Contractor shall warrant performance based on basic link performance and provide patch cords that meet channel performance.
3. All cabling not tested strictly in accordance with these procedures shall be re-tested at no additional cost to the Owner.
4. 100% of the installed cabling must be tested. All tests must pass acceptance criteria defined below.
5. Test equipment shall be fully charged prior to each days testing.
6. Standards Compliance & Test Requirements
   a. Copper cabling must meet TIA 568B Category 6A
   b. All test equipment used must meet the performance specifications defined in paragraph 9 below.

7. Documentation

   a. Test reports must be submitted in electronic format. Hand-written test reports are not acceptable.
   b. An attached affidavit verifying passing execution of all tests. For large installations electronic reports are preferred. Summary reports shall contain the following information on each row of the report: circuit ID, test specification used, length, date of test, and pass/fail result.
   c. Reports must be accompanied by a Certificate signed by an authorized representative of the Contractor warranting the truth and accuracy of the electronic report. Certificate must reference traceable circuit numbers that match the electronic record.
   d. Test reports shall include the following information for each cabling element tested.
      1) Wiremap results that indicate the cabling has no shorts, opens, miswires, split, reversed, or crossed pairs, and end to end connectivity is achieved.

      2) For Category 6A cabling tests results shall include the following test results:

         a) Attenuation, Near End Cross Talk (NEXT)
         b) Power Sum Alien Next (PSANEXT)
         c) Power Sum Near End Crosstalk (PSNEXT)
         d) Insertion Loss (IL)
         e) Return Loss (RL)
         f) Attenuation to Cross Talk Ratio -Far End (ACRN)
         g) Power Sum Attenuation to Cross Talk Ratio - Near End (PSACR-N)
         h) Power Sum Alien Attenuation to Crosstalk Ratio - From Far End (PSAACRF)

i) Far End Crosstalk (FEXT).

j) Power Sum Attenuation to Crosstalk Ratio - Far End (PSACRF)

k) Length

l) Propagation Delay

m) Delay Skew

4) Data that indicate the worst case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combinations and in both directions when required by the appropriate standards. Any individual test that fails the relevant performance specification shall be marked as a FAIL.

5) Length (in meters), propagation delay, and delay skew relative to the relevant limit. Any individual test that fails the relevant performance specification shall be marked as a FAIL.

6) Cable manufacturer, cable model number/type, and NVP.

7) Tester manufacturer, model, serial number, hardware version, and software version.

8) Circuit ID number, date and project name.

9) Autotest specification used.

10) Overall pass/fail indication.

8. Test reports shall be submitted within 7 business days of completion of testing and at least (30) days prior to substantial completion.
9. Test Equipment
   a. Contractor will provide an artifact showing tester has been calibrated within one year of the last test result for this project
      1. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years experience in producing field test equipment. Manufacturers must be ISO 9001 certified.
   b. All test tools of a given type shall be from the same manufacturer, and have compatible electronic results output.
   c. Test adapter cables must be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable.
   d. Baseline accuracy of the test equipment must exceed TIA Level III, as indicated by independent laboratory testing.
   e. Test equipment must be capable of certifying Category 5, 5e, and 6A links.
   f. Test equipment must have a dynamic range of at least 100 dB to minimize measurement uncertainty.
   g. Test equipment must be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.
   h. Test equipment must include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.
   i. Test equipment must be capable of running individual NEXT, return loss, etc measurements in addition to autotests. Individual tests increase productivity when diagnosing faults.

j. Test equipment must include a library of cable types, sorted by major manufacturer.

k. Test equipment must store at least 1000 Category 6 or 6A autotests in internal memory.

l. Test equipment must be able to internally group autotests and cables in project folders for good records management.

m. Test equipment must include DSP technology for support of advanced measurements.

n. Test equipment must make swept frequency measurements in compliance with TIA standards.

o. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.

3.6 QUALITY CONTROL AND FIBER OPTIC CABLE TESTING

A. Quality Control

1. Contractor to procure only new cable and equipment for this project.

2. Contractor to ensure that all equipment and cable are free of defects and are protected under respective manufacturer warranties.

B. Test measurements shall be carried out in accordance with the Tier 2 specification of ANSI/TIA-568-C.0, Annex E, plus an image capture of connector end-faces. Tier 2 testing is a higher level of testing that provides qualitative measures of the installed condition and performance of the cabling system and its components. Tier 2 testing includes length measurement, attenuation measurement, verifying polarity (using an optical loss test set (OLTS) and obtaining a trace and event table of the fiber with an optical time domain reflectometer (OTDR). OTDR traces are used to evaluate the installed cabling for anomalies and assuring uniformity of cable attenuation and connector insertion loss.

C. Testing shall be performed on each optical fiber cabling link (adapter to adapter).

D. All tests shall be documented including OLTS dual wavelength attenuation measurements for single-mode links (1310nm and 1550nm), OLTS length measurements for single-mode links, OTDR traces and event tables for single-mode links, and image captures of connector end-faces.

E. All testing procedures and field-test instruments shall comply with applicable requirements of:

ANSI Z136.2, ANS For Safe Use Of Optical Fiber Communication Systems Utilizing Laser Diode And LED Sources

ANSI/EIA/TIA-455-50B, Light Launch Conditions For Long-Length Graded-Index Optical Fiber Spectral Attenuation Measurements

ANSI/TIA/EIA-455-59A, Measurement of Fiber Point Discontinuities Using an OTDR.

ANSI/TIA/EIA-455-60A, Measurement of Fiber or Cable Length Using an OTDR.

ANSI/TIA/EIA-455-61A, Measurement of Fiber or Cable Attenuation Using an OTDR.

ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Single-mode Fiber Cable Plant.

ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.

ANSI/TIA -568-C.0, Generic Telecommunications Cabling for Customer

Premises. ANSI/TIA -568-C.3, Optical Fiber Cabling Components Standard.

F. Trained technicians who have successfully attended an optical fiber testing training program, which includes testing with an OLTS and an OTDR and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:
   1. Manufacturer of the fiber optic cable and/or the fiber optic connectors.
   2. Manufacturer of the test equipment used for the field certification.
   3. Training organizations (e.g., BICSI, A Telecommunications Association).
   4. The Owner or the Owner's representative shall be invited to witness, review or both witness and review field-testing.
   5. The Owner or the Owner's representative shall be notified of the testing start date, five (5) business days before testing commences.
   6. The Owner or the Owner's representative will select a random sample of 5% of the installed links and test that sample. The measured results obtained from the random sample shall be compared to the data provided by the contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the contractor under supervision of the Owner or Owner's representative shall repeat 100% of the testing at no cost to the Owner.

G. SUBMITTALS

   1. Manufacturers catalog sheets and specifications for the fiber optic field-test instruments including optical loss test sets (OLTS), optical time domain reflectometer (OTDR) and endface inspection capture device.
   2. A schedule (list) of all optical fibers to be tested identified.
   3. Sample test reports.
   4. Acceptance of test results
   5. Link attenuation measurement and allowance calculation
   6. The measured link attenuation shall be less than the link attenuation allowance. The link attenuation allowance is calculated as:
      a. Link Attenuation Allowance (dB) = Cable Attenuation Allowance (dB) + Connector Insertion Loss Allowance (dB) + Splice Insertion Loss Allowance (dB)
      b. Connector Insertion Loss Allowance (dB) = Number of Connector Pairs × 0.4dB
      c. Splice Insertion Loss Allowance (dB) = Number of Splices × 0.15dB
      d. Cable Attenuation Allowance (dB) = Maximum Cable Attenuation Coefficient (dB/km) × Length (km)

Optical fiber and cable type [2]	Wavelength (nm)	Maximum attenuation (dB/km)
Single-Mode Indoor-Outdoor (OS1) (OS2)[3]	1310 1550	0.5 0.5
Single-Mode Outside Plant (OS1) (OS2)[3]	1310 1550	0.5 0.5

0

7. All installed cabling links shall be field-tested and pass the link attenuation measurement and allowance calculation and OTDR analysis. Any optical fiber link that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected link meets performance requirements. The final and passing result of the tests for all links and channels shall be provided in the test results documentation in accordance with Part 3.
8. Individual connector, splice and fiber insertion loss shall be evaluated using the OTDR trace.

H. Optical Fiber Cable Test Equipment

1. The field-test instrument shall be within the calibration period recommended by the manufacturer.
2. The field-test instrument shall contain the most recent software and firmware provided by the manufacturer prior to testing.
3. Optical loss test set (OLTS)
4. The OLTS shall be capable of providing length measurement of the fiber under test.
5. Multimode optical fiber light source
6. Provide dual LED light sources with central wavelengths of 850 nm (±30 nm) and 1300 nm (±20 nm)
7. Output power of -20 dBm minimum.
8. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (see Part 3, 3.2, C, 1, c) with a Category 1 light source.
9. Single-mode optical fiber light source
10. Provide dual laser light sources with central wavelengths of 1310 nm (±20 nm) and 1500 nm (±20 nm).
11. Output power of –10 dB minimum.
12. Power Meter
13. Provide 850nm, 1300nm and 1500nm wavelength test capability.
14. Power measurement uncertainty of ± 0.25 dB.
15. Store reference power measurement.
16. Save at least 100 results in internal memory.
17. PC interface (serial or USB).
18. Acceptable manufacturers, models:
    a. Fluke Networks, OptiFiber (OLTS and OTDR combined)
    b. Fluke Networks, DTX (OLTS; MFM2, SFM2)
    c. Corning Cabling Systems OTS-613QD (OLTS) Exfo, FOT-600 OLTS (OLTS)
    d. Approved equivalent

I. Optical Time Domain Reflectometer (OTDR)

1. Shall have a bright, color transmissive LCD display with backlight.
2. Shall have rechargeable Li-Ion battery for 8 hours of normal operation.
3. Internal non-volatile memory and removable memory device with at least 16 MB capacity for results storage.
4. Serial and USB ports to transfer data to a PC.
5. Multimode OTDR
6. Wavelengths of 850 nm (± 20 nm) and 1300 nm (± 20 nm).
7. Event deadzones typically of 0.5 m at 850 nm and 1.3 m at 1300 nm.
8. Attenuation deadzones 4.5 m at 850 nm and 10.5 m at 1300 nm.
9. Distance range 3 km at 850 nm and 7 km at 1300 nm.
10. Dynamic range 15 dB at 850 nm and 14 dB at 1300 nm.
11. Single-mode OTDR
12. Wavelengths of 1310 nm (± 25 nm) and 1550 nm (± 30 nm).
13. Event deadzones typically of 1 m at 1310 nm and 1 m at 1550 nm.
14. Attenuation deadzones typically of 8 m at 1310 nm and 8 m at 1550 nm.
15. Distance range at least 60 km.
16. +Dynamic range 26 dB at 1310 nm and 24 dB at 1550 nm.
17. Acceptable manufacturers, models:
    a. Fluke Networks, OptiFiber (OLTS and OTDR combined with end face image capture)

b. Fluke Networks, DTX (QUAD-OTDR)
c. Corning Cabling Systems, OV-1000 OTDR Exfo, FTB-150 OTDR
d. Approved equivalent

J. Fiber Microscope

1. Magnification of 250X or 400X for end-face inspection
2. Video camera and display showing magnified end-face image.
3. Camera probe tips permitting inspection through adapters.
4. Capable of saving end-face image.
5. Acceptable manufacturers, models:
   a. Corning Cabling Systems, VIP-CCO-K17
   b. Fluke Networks, OptiFiber (OLTS and OTDR combined with end face image capture)
   c. Approved equivalent

K. Administration

1. The test result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.
2. The test result records saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records.
3. All tests performed on optical fiber cabling that use a laser or LED in a test set shall be carried out with safety precautions in accordance with ANSI Z136.2.
4. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.
5. Dust caps shall be placed on fiber endfaces or adapters for each optical fiber link after all testing is complete on the fiber link.
6. Testing shall be performed in accordance with ANSI/TIA-568-C.0 Annex E, Tier 2 testing on each cabling segment (i.e., verify polarity, measuring length, OLTS attenuation measurement, and OTDR trace).
7. In addition to Tier 2 testing of ANSI/TIA-568-C.0 Annex E, an image of each fiber optic connector endface shall be taken, recorded and provided as part of the records.
8. Optical fiber link test results from the OLTS, OTDR and endface image shall be recorded in the memory of the field-test instrument.
9. Each optical fiber test shall be uploaded to a PC in which the administrative documentation (reports) shall be generated.
10. The records for each test shall be provided to the owner a minimum of two weeks prior to substantial completion in Excel format and the native format to the test instrument. The Owner can supply an Excel spreadsheet template upon request for the contractor's use.

L. Optical Fiber Test

1. Polarity
2. For duplex connector systems, polarity shall be verified. The polarity shall be verified with an OLTS while performing attenuation tests.
3. Length measurement
4. Each optical fiber link shall be measured for its length. The fiber length may be obtained by a capable OLTS or by an OTDR.
5. Attenuation measurement (OLTS)
6. General

a. Optical sources shall be turned on for a minimum of 5 minutes prior to referencing.

b. Test jumpers shall be reference quality and between 1m and 5m in length.
c. Mandrels shall be used when testing attenuation of multimode optical fiber cabling with an OLTS.
d. Where mandrels are used, secure the mandrel to the light source by some means such as a cable tie or tape. Care should be taken to ensure that the fiber jacket is not deformed or damaged when using a cable tie or tape.
e. The light source shall be referenced to the meter a minimum of twice daily (i.e., in the morning and noon).
f. Fiber test jumpers shall be of the same core size as the cabling under test (e.g., single-mode to single-mode, 62.5µm multimode to 62.5µm multimode, 50µm multimode to 50µm multimode). Additionally the test jumpers shall meet the performance specifications of the fiber under test and that of the test instrument manufacturer.
g. Fiber test jumpers shall be cleaned prior to connection to the test instrument. After cleaning, cleaning solutions shall be given sufficient time to evaporate (approximately 30 seconds) prior to the mating of fiber test jumper to the test instrument.
h. The end of the fiber test jumper that will connect to the fiber link to be tested, the adapters and fiber under test shall be cleaned immediately prior to each fiber being tested. After cleaning, cleaning solutions shall be given sufficient time to evaporate (approximately 30 seconds) prior to the mating of fiber test jumper to the fiber under test.
i. The test jumper connected to the source shall not be removed after referencing so as not to adversely influence the attenuation measurement. Removal and reattachment of the test jumper connection from the source may affect the referenced power level. Re-referencing is to be performed if the test jumper is disconnected from the light source.
j. Single-mode optical fiber links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper.
k. Multimode optical fiber links shall be tested at 850 nm and 1300 nm in accordance with ANSI/TIA/EIA-526-14-A, Method B, One Reference Jumper.
l. Multimode and single-mode optical fiber links shall be measured and reported for attenuation in each direction and attenuation bi-directionally (averaged in both directions). The measurements shall be less than or equal to the link attenuation allowance calculation (see Part 1, 1.7, A.).
m. Steps to measure and calculate optical fiber link attenuation include a) verifying test jumper quality; b) setting the reference; c) measuring link attenuation; and d) calculating link attenuation.
n. This example below describes the process when testing multimode fiber with the test jumper connected to the source having five non-overlapping wraps of multimode fiber on a mandrel. The procedure is also applicable to single-mode cabling, however, the five non-overlapping wraps of multimode fiber would be replaced with a single 30 mm (1.2 in) diameter loop of single-mode fiber.
o. Verifying test jumper quality
p. Test jumpers shall be tested for quality prior to use as a test jumper.

See example below.

q. To verify that the test jumpers are in acceptable condition, first reference the light source to the optical power meter (see: http://www.thefoa.org/tech/ref/1pstandards/FOA-3.pdf) Disconnect test jumper (J1) from the power meter (only) and insert a second test jumper (J2) by connecting it to the power meter and to (J1) with a mating adapter (see:

http://www.thefoa.org/tech/ref/1pstandards/FOA-4.pdf) and record the measurement. Disconnect both ends of J2, interchange the ends, and reconnect it and record the measurement. The resulting measurements, P_{verify}, should be within the appropriate connector loss specification. For example, if the connector used is specified at 0.32 dB, the reading on the power meter should be within 0.32 dB of P_1.

M. OTDR Trace

1. An OTDR trace shall be taken of each optical fiber link in one direction to ensure uniformity of cable attenuation and connector insertion loss. Multimode fiber traces shall be taken at 850nm and 1300nm. Single-mode fiber traces shall be taken at 1310nm and 1550nm.
2. A launch cable to the length specified by the manufacturer of the OTDR shall be installed between the OTDR and the first link connection. The launch cable shall be of the same fiber type as the link under test.
3. A receive cable shall be installed after the last link connection to be part of the OTDR trace. The receive cable shall be at least 100m (328ft) in length and of the same fiber type as the link under test.
4. Selectable parameters affecting the OTDR measurement may include the test source wavelength, pulse duration or signal strength, length range, backscatter coefficient, signal averaging (time or count) and the group index of the fiber (also known as the index of refraction or the refractive index). The display shall be adjusted to view the region of interest on the trace on both the horizontal and vertical axes.

N. Administration

1. Test results documentation
2. Test results saved within the field-test instrument shall be transferred into a Windows™- based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”.
3. The test results documentation shall be available for inspection by the Owner or the Owner’s representative during the installation period. The contractor shall retain a copy to aid preparation of as-built information.
4. The records for each test shall be provided to the owner a minimum of two weeks prior to substantial completion in Excel format and the native format to the test instrument. The Owner can supply an Excel spreadsheet template upon request for the contractors use.
5. Circuit IDs reported by the field-test instrument shall match the label ID specified by the Owner.
6. The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information
7. The identification of the customer site as specified by the end-user
8. The name of the standard selected to execute the stored test results
9. The name of the test personnel
10. The date and time the test results were saved in the memory of the tester
11. The manufacturer, model and serial number of the field-test instrument
12. The version of the test software and the version of the test standards database held within the test instrument
13. The value of the ‘index of refraction’ used for length calculations
14. The fiber identification number
15. The length for each optical fiber calculated by the OLTS.
16. Test results to include OLTS attenuation link and channel measurements at 850 nm and 1300 nm for multimode cabling, and at 1310 nm and 1550 nm for single-mode cabling and the margin (difference between the measured attenuation and the test limit value).
17. Test results shall be submitted to include OTDR link and channel traces and event tables at 850 nm and 1300 nm for multimode cabling, and at 1310 nm and 1550 nm for single- mode cabling and the margin (difference between the measured attenuation and the test limit value).
18. The length for each optical fiber calculated by the OTDR.
19. The overall Pass/Fail evaluation of the link-under-test for OLTS and

OTDR measurements

20. A picture or image of each fiber end-face

O. Cable Labeling and Site As-Built Documentation

1. Post in prominent location in communications each equipment room a list of incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
2. Show building floor plans with cabling and port labeling. Identify labeling convention and show labels for telecommunications closets, hardware, horizontal cables, work areas, grounding buses and pathways, and equipment grounding conductors.
3. Follow convention of ANSI/TIA/EIA-606-A or as indicated or directed in writing by the designated representative of the Owner.
4. Label each horizontal and backbone cable within 4 inches of each termination, where it is accessible in a rack, cabinet, junction box or outlet box.
5. For labeling of Patch Panels coordinate with Owner for labeling scheme. Label each connector, faceplate with computer-printed type with printing area and font color.

3.1 PRE-INSTALLATION INSPECTION

A. Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Vendor.

B. If post-manufacture performance data has been supplied by the manufacturer of cables or connecting hardware, copies of such data are to be kept for inclusion in the Documentation and made available to the Owner or Architect upon request.

C. All materials are to be new and unused.

3.2 FINAL ACCEPTANCE

A. Acceptance

1. Once all work has been completed, test documentation has been submitted, and Owner, Architect and Consultant is satisfied that all work is in accordance with contract documents, Contractor shall be notified in writing of formal acceptance of the system.

2. Acceptance Requirements

a. Contractor must warrant in writing that 100% of the installation meets the requirements specified under Part 2, section 3 (Standards Compliance & Test Requirements) above.

B. Contractor shall warrant Installation against all product defects for a period of 30 years.

3.3 WORKMANSHIP

A. The installation of all work shall be neat. All boxes, equipment, etc., shall be plumb and square.

B. The Contractor shall keep the job adequately staffed at all times. Unless illness, loss of

personnel, or other circumstances beyond the control of Contractor intervene, he shall keep the same individual in charge throughout its execution.

C. Following installation, all soiled, abraded or discolored surfaces of work installed herein will be cleaned and left free from blemishes or defects.

D. Work that is damaged or improperly installed will be removed and replaced and the entire installation left in complete satisfactory condition.

E. Clean the areas affected by the Work to a level of operational cleanliness, vacuum clean, and wipe down all metal and plastic surfaces to remove any construction dust..

F. The Contractor shall remove from the job site all rubbish and refuse at the end of each day and shall keep his work area clean.

G. Any damage brought about by Contractor's work shall be repaired by the Contractor at no cost to the Owner.

H. It shall be the responsibility of the Contractor to cooperate with other trades in order to achieve well-coordinated progress and satisfactory final results. He shall watch for conflicts with work of other contractors on the job and execute, without claim for extra payment, moderate moves or changes as are necessary to accommodate other equipment or preserve symmetry and pleasing appearance.

J. For duration of installation and warranty period, service calls must be responded to within two hours of request, by arrival of technicians and equipment to the project site.

END OF SECTION 271000

SECTION 271100 - AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Certain requirements common to all the mechanical and electrical trades (Fire Suppression, Plumbing, HVAC, Electrical, and Tele/Data) are specified in Division 20 and 26. To avoid repetition, they are not repeated in each relevant Division of the Specifications. However, these requirements are applicable to the work of this Division and are hereby incorporated by reference.

B. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

1.2 WORK BY CONTRACTOR:

A. Provide and install all conduit and backboxes for Audiovisual (AV) systems for wiring and equipment to be installed by AVC.

B. Provide all 120V wiring, conduit, backboxes and wiring devices to supply power for AV systems, as described in this document and as shown on associated drawings.

1.3 WORK BY UNIVERSITY'S AUDIOVISUAL CONTRACTOR (AVC) UNDER SEPARATE CONTRACT:

A. Provide complete and operational Audiovisual (AV) systems as described in this document and as shown on associated drawings (see Appendix). Systems are to include plenum rated cables, accessories and miscellaneous items to ensure a complete and operational installation.

B. Provide the plenum rated cabling, proper mounting, wiring within devices, device locations, associated equipment, hardware, firmware, and software.

C. Provide materials in quantities sufficient for a complete installation(s) as indicated in drawings and in this specification, whether or not all such components are contained in the drawings and specifications.

1.4 SUMMARY

A. The Audiovisual systems consist of furnishing and installing the audiovisual equipment, connectivity, software, programming, accessories, and related items required to ensure complete and operational systems as described and as indicated in the drawings including:

1. Building secured, ceiling mounted mechanical structures and supports as required in open and closed ceilings for ceiling mounted devices, flanges, pipes, mounts, etc.;
2. AV cable pulls as described, indicated on the drawings, or as otherwise required. These cables shall be installed within an infrastructure of electrical conduits, boxes, wall, floors, and ceiling, or as indicated, and/or required;
3. Furnish and install video displays and/or projectors, wall mounts, ceiling mounts, projector ceiling mounts, projector wall mounts, projector threaded iron mounting pipes and associated flanges, brackets, trim, accessories, and supports.

4. Projection screens, mechanical mounting structure and support for projection screen, screen case, motor, screen roller, screen surface, screen motor and control line-voltage wiring, and low voltage cable pulls related to the projection screen, and;

5. Furnish and install speakers, rough-in-pans and back boxes in hard plaster and gypsum board ceiling locations, tile-bridge hardware in hung tile ceilings, and provide and install any other special permanently installed audiovisual items that require access to the building's infrastructure during the open-wall and open-ceiling phase(s) of the construction:

6. Provide Audiovisual equipment, control systems, custom plates, plates, projectors, speakers, touch control panels, pushbutton control panels, custom engraved pushbuttons, custom machined and engraved plates, cameras, microphones, audio sources, video sources, switchers, scalers, interfaces, displays, racks, workstations, custom furniture and lecterns, conferencing, power supplies, amplifiers, connectors, adapters, and related systems as shown on associated drawings. Systems shall include patch cables, in-rack jumpers, user interface cables, accessories and miscellaneous items to ensure a complete and operational turnkey installation.

7. Provide programming of equipment/systems, design and layout of touch-panel templates, programming of touch-panels, buttons, and controls, software installation, connectivity to LAN where necessary

B. The work under this specification shall include the furnishing of all material, labor and the performance of all operations to provide a complete ready to use audiovisual systems in each and every space shown on the drawings, and as described herein.

C. Furnish materials in quantities sufficient for a complete installation(s) as indicated in drawings and in this specification, whether or not all such components are contained in the drawings and specifications.

D. Terminate cables as required per manufacturer's specifications to interface to all system devices.

E. Provide touch control panel icon button and graphics templates showing arrangements and functions to conform to owner's standards, for owner review, prior to full control system programming. Make changes to touch panel layout, functionality, and icons, as coordinated with and described by the owner.

F. The work of this section is work-for-hire. The software, licenses, programming, code, templates, notes, source code, and other work products are the property of the Owner and are to be delivered to the Owner as part of the project close-out submittals.

G. Provide current equipment models: six months prior to project completion, provide updated submittals for each projector and display. Confirm that the items in this submission comply and are compatible with the size, design, and intention of the project as well as are compatible with the wiring, cabling, boxes, mounts, and accessories. Do not order and furnish these devices without approval of this second submittal.

1.5 OBTAINING INFORMATION

A. Obtain the manufacturer's recommended installation practices, guidelines, and requirements.

1.6 COORDINATION WITH PROJECT TEAM

A. Provide a Project Manager who will act as a single point of contact for all activities regarding this project. The Project Manager must be a management employee and will not be involved in performing installation work.

1.7 ACTION SUBMITTALS

A. Complete submittals: provide one complete submittal package with the exception of the close-out submittals. Incomplete submittals will be rejected and returned for completion and resubmission.

B. Product Data:

1. Provide a summary spreadsheet showing each item for each room and associated information identified below:

a. Item name

b. Manufacturer description

c. Manufacturer part number

d. Quantity required for the project

e. Accessories and/or related items

f. “As specified” yes/no

g. If not as specified, provide “or equal” data

h. Page number in submittal package where item product information starts

2. For each item, provide manufacturer data sheets clearly marked to identify the specific item and configuration being submitted. Organize this information in the order identified in item 1.6.A.1 above.

C. Shop Drawings:

1. Provide room layout drawings showing the devices, connections, cabling, and related information. Identify each device.

2. Provide functional wiring diagrams for all audiovisual signals including: Audio, Video, Control, and Power & AV LAN wiring.

3. Provide room cabling or cable riser diagrams for each system.

4. Provide proposed Audiovisual equipment cabinet/rack elevations.

D. Contractor Qualifications:

1. The Audiovisual Contractor shall be manufacturer certified and authorized, and manufacturer trained to distribute and install the submitted system equipment and components from the relevant manufacturer(s). Submit evidence of the following:

a. Manufacturer’s authorization to supply product from the submitted system manufacturer with the bid response.

b. Manufacturer’s authorization to officially represent the manufacturer’s product warranty for the entire warranty period.

c. Three (3) references of work similar in type to that proposed herein. The references must be recent and accompanied by name of account, address, and contact name and telephone number.

1.8 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Include wiring room layouts, showing equipment mounting locations, pathways, and coordination with building systems.

B. Control system graphics layouts for owner review and approval.

C. Product Certificates: For each device showing compliance with codes, standards, and project requirements.

D. Field quality-control test reports.

1.9 CLOSEOUT SUBMITTALS

A. Operation and maintenance data: Provide operation, and maintenance manuals for each item/system.

B. As-built drawings:

1. Provide AutoCAD and PDF format, which show the actual construction conditions and configurations. Make all modifications to these drawings by removing all superseded data and show the completed “As-Built” installation.

2. The “As-Built” drawings must be made available in the form of reproducible prints and an AutoCAD drawing file format for input to other systems. Maintain the as-built drawings throughout the project, and provide two hard copies, and electronic copies of the final conditions as-built drawings.

3. Deliver the completed Record Drawings, identified above, properly titled and dated to the Owner labeled “As-Built” drawings. These drawings shall be completed and delivered two (2) weeks prior to the cutover and become the property of the Owner.

C. Control Programming

1. Furnish the documentation of last calibration in the form of a certificate and all test results as part of the “As-Built” package. Handwritten test results are not acceptable.

2. Provide an editable copy of all control programs which will be property of the Owner. Programs may include but not be limited to:

a. Final Audio DSP files including gain settings, calibrated room EQ settings, microphone and assistive listening channel frequencies;

b. Video signal routing, videowall graphics processor settings;

c. Control System logic files with editable source code;

d. Control System graphical touchpanel files;

e. Custom calibration settings for projector, monitors, and video displays.

D. Provide a list of necessary spare parts as recommended by the manufacturer to maintain and service the equipment being installed, and a schedule for obtaining and storing these parts.

1.10 FEES AND PERMITS

A. Obtain the necessary permits and pay all applicable fees.

1.11 QUALITY ASSURANCE

A. Verify actual conditions. Review the specifications and drawings, and advise in writing of any conditions, which may adversely affect the work, prior to the bid date. If no exceptions are presented, the Audiovisual Contractor shall become responsible for any changes to the work required as a consequence of such preexisting conditions.

B. Material Provided:

1. The Audiovisual Contractor shall furnish and install new manufacturer certified components.

1.12 WARRANTY

A. Provide a one (1) year warranty of the installed system against defects in material and workmanship. The warranty shall include response to the site to initiate a repair within 24 hours of a reported problem. The warranty offered shall be certified and honored by the system manufacturer(s). Labor and materials shall be provided at no expense to the Owner during normal working hours. The warranty period shall begin on the date of system acceptance by the Owner and/or Engineer. The warranty period will start upon the acceptance of the operational system(s) by the Owner, and the completion of training.

B. Maintain a supply of necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being installed during the Warranty period.

C. Provide an optional service contract offering continuing factory authorized service for two (2) years, for this system after the initial warranty period.

1.13 SUBMITTAL SUMMARY

A. The following is a summary table of the required submittals. It is provided as a reference and is not a complete list of the required submittals but provides guidance. Additional submittals may be required for the project. Refer to project documents for additional requirements. Submittals that require modification, replacement, additional information, and other changes are in addition to the submittals below and are required as appropriate and/or required.

Submittal
Product Summary Spreadsheet
Product Data Sheets
Shop Drawings
Contractor Qualifications
Coordination Drawings
Product Certificates
Field Quality Control Test Reports
O&M Manuals
As-built Drawings
Spare parts for use by Owner
Software, licensing, Configuration Files etc.
Test Results
Warranty
Optional service contract proposal

PART 2 - PRODUCTS

2.1 GENERAL

A. The Audiovisual Contractor shall furnish all work referred to in this specification in compliance with National, State and Local codes. Material shall be furnished and installed in strict compliance with all requirements of these codes. Labor, materials, and systems supplied under this contract will be in full compliance with the NFPA 70 National Electrical Code, latest version.

B. Provide complete and operational systems. The Audiovisual systems include, but are not limited to projection systems, projectors, monitors, LCD/LED/OLED/Plasma displays, video control systems and interfaces, lighting control systems, audio systems, unified conferencing systems, audioconferencing systems, video conferencing systems, speakers, amplifiers, microphones, switchers, speech reinforcement systems, assistive listening systems, control panels, wireless and remote touch screen controls, DVDs, wiring, connectors, connections, accessories and miscellaneous equipment required to provide complete operational systems as indicated.

2.2 ADDITIONAL REQUIREMENTS

A. Ambient Light Control

1. Provide connection to and integration with light control systems, shades, and other means of light control within spaces that are equipped with audiovisual systems. This applies to locations and systems where Rowan directs that the AV system is to be integrated with the lighting control and/or window treatments for coordination of AV presentation modes.

B. Effects from Building Vibration

1. In cases where the audiovisual systems are or may be subject to vibration, and/or impacted by vibration, provide the solutions to remedy vibration include contracting with a vibration engineering specialist, assisting in making changes to the device or machinery creating the vibration and/or making changes to the building. Where vibration is affecting the audiovisual systems, provide vibration isolators, weights, bracing, dampener(s), cushions, springs, or vibration isolators.

C. Interconnections to the fire alarm system

1. Coordinate with local code officials, Rowan University public safety officials, and the project team to confirm the specific requirements for fire alarm and notification system override of active AV systems and provide the required interfaces, controls, and connections. Typical requirements, at a minimum include the following.

2. Provide connections from the fire alarm system and emergency notification system to each of the audiovisual systems to override local programming in the event of an emergency. Coordinate connection to the fire and emergency notification systems with the systems provider.

3. Equip each system with contacts, inputs, cabling, programming, and accessories to make the connection to the fire and emergency notification systems;

PART 3 - EXECUTION

3.1 GENERAL

A. Meet with project manager, and other designated parties for a coordination meeting prior to commencement of work.

B. Delivery, Storage, and Handling

1. Maintain and protect materials in compliance with manufacturer's requirements and/or recommendations.

2. Open each container; verify contents against packing list; and file copy of packing list, complete with container identification, for inclusion in operation and maintenance data.

3. Mark packing list with the same designations assigned to materials and equipment for recording in the system labeling schedules.

4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials. If directed by the Owner, discard of the packing material, containers, and other non-material items.

C. Identification and Documentation

1. All equipment cables and termination points will be clearly and permanently marked in accordance with standard audiovisual nomenclature and as presented in the working drawings.

2. Labels are to be typed or printed on thermal transfer labeling system, dot matrix or laser printer using adhesive labels or other permanent marking strips. Hand printed labels are unacceptable.

D. Examine drawings, details, and other sections of the specifications for requirements, which affect work under this section.

E. Employ standard installation trade practices, including the following:

1. All devices shall be securely mounted;

2. There shall not be any exposed electrical connections on any devices;

3. Exposed cabling is not acceptable;

4. Provide conduit or raceway system for cabling within inaccessible (hard) ceiling areas and a surface conduit or raceway system for exposed (bare) ceiling areas, and a surface conduit or raceway system for vertical areas where cabling cannot be placed within walls (example: solid concrete);

5. In suspended ceiling areas the cables shall be supported via wide base J-hooks attached to the existing building structure and framework at a maximum of four (4) foot intervals. Furnish and install CMP rated cable management straps required by code. Comply with the manufacturers' requirements for bending radius and pulling tension of all cables. Do not attach to lift out ceiling grid supports or lay directly on the ceiling grid;

6. Do not attach to or support cables by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space;

7. Use only those cables and wires or their equivalent types required for the devices listed for this particular installation;

8. Cabling placed on this project shall be UL rated CMP, CL3P, or CL2P. Furnish and install systems including cable and hardware that complies with the requirements as outlined in the National Electric Code (NEC□) Articles 725, 760, 770, and 800 and the appropriate local codes. All copper cabling shall bear CMP UL designation;

9. Wires and cables shall be clearly, logically and permanently identified with heat-shrink wire markers with machine-printed characters;

10. Provide joints and splices made with wire connectors, wire nuts, terminal blocks, or rosin-core soldered, where applicable. Cables are to be home run, without splices, unless otherwise noted. Acceptable splice points shall be enclosed in listed metal electric boxes, and shall utilize listed fittings to transition to cable, or listed conduit fittings as needed;

11. Panel enclosures shall be enamel painted 16-gauge steel NEMA-1, hinged key- locking cover, with door tamper switch, mercantile grade enclosures;

12. Conduits and Boxes: Comply with requirements in Division 26.

F. Schedule, arrange, and coordinate with involved parties/trades for shipment (as applicable), arrivals, loading dock, elevators, acceptance, storage, and security of equipment and materials. Assure that these activities do not interfere with other trades or the progress of this project.

G. Provide the following miscellaneous items necessary to make a complete, functional, and satisfactory installation, including but not limited to patch cables, wire, connectors, terminals, adaptors, plugs, jacks, splitters, taps, mounting brackets, transformers, hardware fasteners, bezels, strain relief, bushings, adhesives, paints, gaskets, sealants, electrical tapes, fish paper and other insulation, rosin-core soldered connections, cable ties, shrinkable insulation, corrugated flexible tubing, engraved instructional plates and labeling, and secondary electrochemical batteries.

H. Provide technician coverage during installation of all related systems and hardware. Assist in required installation, testing and certification. Coverage requirements will be determined and scheduled by the owner, or owner's representative, in conjunction with provider of related hardware.

3.2 CODE COMPLIANCE

A. No penetrations to fire-rated structures are allowed without prior approval of the General Contractor.

B. Fire stopping shall be done in an approved method where necessary to ensure the integrity of all fire-rated walls, ceilings, and floor penetrations effected by this installation.

C. All cores and penetrations must be fire stopped in an approved method. All fire stop material must be qualified UL & ASTM-rated, meeting adequate FT requirements.

D. Seal all openings between floors, through rated fire and smoke walls, existing or created by the Audiovisual Contractor for cable passage. Sealing material and application of this material shall be accomplished in such a manner that is complies with the manufacturer specification, National, State and Local codes.

E. Furnish the necessary material and labor to create the necessary cores and other openings that are required for cable pathways.

F. Furnish the necessary material and labor to seal all pathways created and /or utilized for the cable installation.

G. The codes referred to in this specification are National, State and Local Electric Codes latest edition; all work shall be furnished and installed in strict compliance with the requirements of these codes.

H. In the case of conflict between the Contract Documents and the Governing Code Ordinance, the more stringent standard shall apply.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Provide all necessary test equipment and perform all work necessary to determine that the systems meet the requirements of this specification.

2. Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts.

a. Use an appropriate Category Cable tester for structured cabling runs. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA 568-B.1, "Commercial Building Telecommunications Cabling Standards - Part 1: General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA 568-B.1.

b. Use an appropriate Audio Impedance Meter capable of measuring VAC speaker loads up to 100k ohms to test for connectivity, load, and shorts. Measured loads should be equivalent to calculated loads while accounting for transformer and line loss.

c. Use an appropriate Video Test Generator capable of reproducing signals up to maximum resolution available for each video system. Confirm HDCP and EDID settings are correct.

3. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.

4. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

5. Test all wireless devices within the spaces to ensure they will operate as designed and that the optimum wireless channels have been chosen to avoid interference.

6. Test the functional parameters of stand-alone devices and integrated interdependent equipment features. Test the systems and control systems. Provide written notice to the Engineer of intent to test systems at least one week prior to test.

7. Conduct the operations of each system, sub-system, and component. Confirm that the sequence of operations and normal system functionality are observed. Modify the programming and installation to provide the required and specified operation.

C. Devices and circuits will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports for submittal as described in Section 1.8 Closeout Submittals.

3.4 CLEANING

A. Clean all equipment and work areas of this scope. This work will include, but not be limited to wiping & dusting of work areas, removal of streaks, stains, and assurances that all systems and components as represented are new and undamaged.

3.5 OWNER TRAINING

A. Provide two one-hour sessions of demonstration and orientation (training) by a senior technician, or other qualified approved personnel, for each of the installed systems. Coordinate with the designated representative of the owner, and complete training the week prior to occupancy, or as scheduled with the owner. Demonstrate and explain:

1. The physical configuration and interrelationship of the components of each system.

2. Labeling and interconnection techniques used in each installation.

3. Applications or unique connections or interfaces currently in use on this site.

4. A review of warranty documents for each system.

B. Coordinate with the designated representative of the owner, and complete training the week prior to occupancy, or as scheduled with the owner.

C. Provide four hours of training on the content of operating manuals, user guides, and record documentation for each system. Training for all systems will be provided at the project site and coordinated with the owner.

D. Train using the equipment specified and installed under this document.

3.6 SYSTEM ACCEPTANCE

A. Sign-off for acceptance of system shall occur only after submission of final documentation of system including:

1. Test results indicate 100 percent functionality, and;

2. System operation & maintenance manuals are transferred to the system owner, and;

3. Training has been accomplished to the owner’s satisfaction.

4. Failure of the Audiovisual Contractor to obtain sign off will result in the Audiovisual Contractor remaining responsible for extending, at no charge to the owner, conditions of the warranty and guarantees until such time that sign off had occurred. Time included in the

above condition will be included in the standard warranties.

END OF SECTION 271100

SECTION 280000 – ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and Division 01 Specification Sections, apply to this Section.

B. Section 08710 Finish Hardware

C. Section 271000 Information Technology Cable Plant

1.2 SYSTEMS OVERVIEW

A. Rowan University maintains a partner/vendor who shall provide Rowan-standard materials required for the security system. This partner will also provide point-to-point writing diagrams that will conform to the general bid documents. This specification details which items are provided by Rowan, and which items are provided by the contractor. The contractor shall familiarize themselves fully with this document. This section includes a Summary of the overall specification.

B. Rowan University maintains the following applications and standards to manage various security devices.
   a. Genetec Omnicast for Video surveillance management
   b. AccessIT by ACRE for card/credential based physical access control.
   c. Axis cameras for surveillance sensors, allowing only certain certified models into the environment.

C. The University utilizes a Best Large Format high security core and key. Contractor shall ensure all locks provided under this contract are compatible with this format including provision of correct core housing, core spacer ring, and tail pieces.

D. The University produces its own proprietary “one-card” including proprietary encryption. This contract will not include any additional credentials. All hardware supplied under this contract must be compatible with Rowan’s credentials.

1.3 SCOPE OF WORK

A. Provide all cable pathways inclusive of pathways around and inside door frames, above dropped ceilings, underground, and between walls, as required by the contract drawings and specifications.

B. Provide, install and terminate all low voltage cabling required for the security system. Coordinated cable pull lists and termination diagrams will be provided after award.
C. Install and provide power to all access control power supply cabinets.

D. Provide and install cable between access control power supply cabinets and wireless lock hub/repeaters, which will be located within 50’ of each wireless lockset.

E. Provide and install and provide test documentation for category cables (Cat 6A) from appropriate IDF’s to location of each of the following:

    a. Each IP Camera
    b. Each wireless lock hub/repeater.

F. Include attendance at coordination meetings with internal Rowan technical team (minimum 6 meetings) in addition to the normally required construction project meetings. The purpose of these meetings will be to transfer knowledge needed for a successful project, and to monitor adherence to university policy.

G. Assign a foreman level or higher POC to participate in system commissioning and address infrastructure issues that may arise during system testing.

H. Install a fire alarm zone output module (ZO) within three feet of each Access Control panel and have the output modules programmed to Change state from Closed to Open upon any fire alarm condition. (But not for any trouble types)

I. The Installation Contractor shall ensure proper interface operations of the security management system, access control, intrusion detection, the support subsystems, and power systems.

J. The system cabling, located in interior areas shall consist of plenum rated cable for locations above suspended ceilings, in walls, or run in electrical metallic tubing (EMT) conduit (in non public areas) or Wire Mold (in public areas) when exposed.
    a. Public areas include: Corridors, classrooms, lobby, gym, media center, offices, etc and Non-Public areas include: storage, electrical rooms, boiler rooms, janitor closets, etc.
    b. For new construction, all devices, backboxes, wiring and conduit shall be completely concealed.

1.4 WORK BY OWNER/ ROWAN UNIVERSITY

A. Provide PoE enabled Networking switches.

B. Provide management and storage servers.

C. Provide locking device cores and keys.

D. Provide access control power supplies to be installed in IDF closets by the contractor.

E. Provide wired card readers for installation by the contractor.

F. Provide, for installation and termination by this contractor.
   a. Door position switches (Door contacts)
   b. Motion sensors

G. Provide, for installation by the contractor, battery-powered locksets as detailed in the project drawings.

H. Provide, for installation by the contractor, IP Cameras and patch cables.

1.5 SUBMITTALS

A. The Installation Contractor shall submit acceptable equipment for review by the Engineer and the Architect. The Installation Contractor shall bear all liability and penalties for damages arising from his failure to submit equipment that meets these Specifications, including, but not limited to, any liabilities and penalties for failure to meet construction deadlines.

B. Final determination of compliance with this Specifications shall be with the Engineer and the Architect, which, at its discretion, may require proof of performance at the cost of the Installation Contractor.

C. At the start of work, the Installation Contractor shall submit the following material for review by the Engineer and the Architect:

1. Shop drawings:
   a. Typical field equipment mounting detail drawings for passive infrared motion detectors-where applicable, access control card readers, magnetic door contacts, request to exit/emergency exit devices, video cameras, video camera housings and mountings, power supplies, and UPS equipment, where applicable.

   b. Drawings for the school showing the layout configuration and location of all Installation Contractor installed equipment related to this project.

c. Catalog data sheets of: the security management system mini head end and field panels (include specific modules in the field panel or ancillary to the field panels); passive infrared

motion detectors; power supplies;video intercom stations, access control card readers; magnetic door contacts; power supply and ancillary equipment; request to exit devices, lightning/surge protector modules for signal and power; and wire/cable.

2. The Installation Contractor shall meet ICO/ANSI A117.1-2017 ADA requirements. Shop drawings shall reflect ICO/ANSI A117.1-2017 ADA requirements regarding height, type of function, accessibility, and other applicable ICO/ANSI A117.1-1228 ADA guidelines. As part of the Closure documents the Installation Contractor shall provide a statement that it has complied with ICO/ANSI A117.1 requirements.

3. Ampere loads for the security management system; the intrusion system, passive infrared motion detectors where applicable (battery Ampere-Hour capacity).

4. A schedule identifying the types and quantities of the security management system panels, each input terminal and connected passive infrared motion detector (where applicable), magnetic door contact, access control card reader, and request to exit/emergency exit device, and the identification of each output terminal and connected output device.

5. Samples of various items when so requested.

1.6 APPLICABLE LISTINGS, CODES AND STANDARDS

A. All equipment shall be U.L. listed or meet U.L. requirements for its intended use.

B. ANSI/DHI A115 Series - American National Standard Specifications for Steel Door and Frame Preparation for Hardware.

C. ANSI A117.1 (2017) - Accessible and Usable Buildings and Facilities.

D. BHMA A156.2 - American National Standard for Bored and Pre-assembled Locks and Latches.

E. BHMA A156.13 - American National Standard for Mortise Locks & Latches; Builders Hardware manufacturers Association.

F. BHMA A156.18 - American National Standard for Materials and Finishes.

G. Federal Communications Commission (FCC), Code of Federal Regulators, Part 15, Subpart B, Radio Frequency Devices, Unintentional Radiators

H. FF-H-106C - Hardware, Builders', Locks and Door Trim, General Specification for The Americans with Disabilities Act

I. IBC 2021 - International Building Code.

J. Institute of Electronic and Electrical Engineers (IEEE) 802.3 Ethernet standards

K. NFPA 70 (2020) - National Electrical Code.

L. NFPA 80 (2019) - Fire Doors and Windows.

M. NFPA 101 (2021) - Life Safety Code.

N. Underwriters Laboratories (UL)

O. UL294 - The Standard of Safety for Access Control System Units

P. UL603 - Power Supplies for Use with Burglar-Alarm Systems

Q. UL864 - Standard for Control Units and Accessories for Fire Alarm Systems

R. UL1076 - Proprietary Burglar Alarm Units and Systems

S. UL1481 - Power Supplies for Fire-Protective Signaling Systems

T. UL2044 - Commercial Closed-Circuit Television Equipment

U. UL2572 - Mass Notification Systems

V. All raceways and wiring shall be installed in compliance with NFPA Standard 70 (National Electrical Code - 2020). All applicable portions of the National Electrical Code shall be implicitly followed, in particular with regard to material type and quality, circuitry extensions from and connections to outlet and junction boxes, panel boards and similar appurtenances.

W. The system equipment and its installation shall comply with all other local codes and Authorities having Jurisdiction (AHJ's).

1.7 QUALITY ASSURANCE

A. It is the intent of these specifications to provide for a security management system and intercom subsystem that comply in all respects with the requirements of all applicable codes and standards and performance objectives. Equipment, material, installation practices, etc. that do not meet these requirements or do not meet the performance standards herein specified shall not be acceptable.

B. Equipment for security management system, video system, and intercom subsystem shall be as shown on the drawings and as herein described in this Section. The drawings shall illustrate the quantities and locations of devices to be provided.

PART 2 - PRODUCTS

2.1 POWER SOURCES FOR ACCESS CONTROL

A. Shall be provided to this contractor for installation in appropriate IDF's. The Power

supplies include hotel space for the controllers that manage wired doors. Assume a requirement of one power supply cabinet for every four wired access control doors shown on in the plans. Additional requirements per cabinet include:

a. Provide dedicated 120V, single phase power to each cabinet and red-line the electrical panel plans depicting the breaker in use.
b. Provide network drop, in accordance with Division 27 specifications.
c. Electronic Control panels and enclosures should be installed in locations that are readily accessible for check out and service in approved locations. Ensure adequate clearance so that panel doors can open fully. {See panel layout in drawings.}
d. No excess wire will be looped or coiled in the control cabinet.
e. For reference, a typical power supply shall be a Life Safety FPO250B100C8D8E4M or similar.

2.2 POWER SOURCES FOR VIDEO SURVEILLANCE

A. Shall be provided by the owner via Owner-Supplied PoE Network Switches.

2.3 UNINTERRUPTIBLE POWER SUPPLY

A. Shall be provided for the card access system via dedicated batteries connected to the Power supply chargers by Rowan.

B. Shall be provided for the video system by the owner via UPS power-backup to the PoE network switches.

2.4 WIRELESS LOCK REPEATERS AND NODES [GW]

A. This contractor shall install both cable type (a) and (b) listed in section 2.9 from each IDF to the location of up to 20 Wireless lock repeaters (GWE/Engage BLE repeaters) Power and data shall be terminated on each end of the run per post-award supplied termination drawings.

2.5 ACCESS CONTROL SYSTEM HARDWARE

A. Shall be provided and installed in the hotel space of the access control power supplies by the Owner.

B. This contractor shall provide and install Access Control cable (see section 2.9) between the power supply cabinets and each wired door. Install means all of the following:
a. Provide pathways and fire sealing in accordance with project specifications for electrical and Teledata work.
b. Provide pathways required inside door frames in accordance with door elevation layouts provided post award.
c. Install cable and terminate in the IDF-wall-installed controller as well as on the reader, lock, request to exit sensor and door position switches at each door in the plans and specifications.

2.6 WIRELESS INTEGRATED CREDENTIAL READERS [CW]

A. Shall be provided for the card access system via dedicated batteries connected to the

Power supply chargers by Rowan.

B. Shall be provided for the video system by the owner via UPS power-backup to the PoE network switches.

2.7 ACCESS CONTROL CREDENTIALS

A. Shall be provided by the Rowan.

2.8 WIRED ELECTRIFIED LOCKING DEVICES & ACCESSORIES

A. See Section 87010 – Finish Hardware

2.9 SECURITY SYSTEM CABLES

A. The drain wires from all shielded cables will be neatly terminated to a good common ground at the controller. Grounding will be provided at the controller end only. The device foil shall be neatly clipped and taped to prevent fraying or field grounding.

B. All input and output wire runs will be continuous from the controller or interface panel to its respective input or output point in the field, (device, card reader, relays, etc.) with no splices. (unless otherwise specified) Splices are permitted in junction boxes above doors, and other specified locations, to allow for supervision of inputs and connection to end device which have pigtails.

C. Low voltage (<48V) cable runs will be installed in separate raceways from 120 VAC or higher voltage wiring.

D. In control cabinets, 120 V or higher cables will be separated from low voltage (<48v) cables by a minimum of 2”, and be kept in separate raceways.

E. Conduit, raceway and trough will be sized so as not exceed NEC code or project standard requirements for % full with all wires, including spares, installed. This will apply to low voltage as well as 120 VAC wiring.

F. All wiring and tubing routed through boxes, panels, enclosures or any passageway will be protected from damage by grommets, nipples, or protective connectors.

G. No conduit or wiring will be snaked or routed through pipe or duct insulation.

H. All tie-wraps will be clipped neatly back to the head.

I. An 18-inch bend radius is required for any conduit or raceway intended for fiber cables.

J. Markers shall be of the wrap-on type such as those produced by Brady, T&B or 3M. String or toe tag markers shall not be used.

K. All wire and tubing will be neatly and uniformly tagged in all pull boxes, panels and at each end of the run. Tag names shall be as indicated on the drawings.

L. All final cable, conduit and tubing (EXP) runs will be clearly marked in red pencil on a set of the appropriate as-built drawings. This set of marked-up prints will become property transmitted to the Rowan project manager.

M. Pull box and field panel locations will be clearly marked on the drawings by the in-stalling contractor.

CABLE TYPES

ACCESS CONTROL CABLING

Element 1: Lock Power
Conductor Size: 18 AWG
Stranding: 7/30 Bare Copper
No of Conductors: 4
Jacket Color: White/Purple

Element 2: Card Reader
Twisted Pairs: 3
Conductor Size: 22 AWG
Stranding: 7/30 Bare Copper
Jacket Color: White/Yellow

Element 3: Door Contact
Conductor Size: 22 AWG
Stranding: 7/30 Bare Copper
No of Conductors: 2
Shielding: Overall Aluminum Mylar with
Stranded T.C. Drain Wire
Jacket Color: White/Green

Element 4: Red Request to Exit
Conductor Size: 22 AWG
Stranding: 7/30 Bare Copper
No of Conductors: 4
Jacket Color: White/Red

Specifications
Overall Jacket: LS PVC, Yellow
Overall Diameter: 0.375 in
UL Flame Test: NFPA 262
RoHS Compliant: Yes

WIRELESS REPEATER CABLING (Cable A for data, Cable B for Power)

Cable A (RS485)
No of Conductors: 2
Conductor Size: 24 AWG
Stranding: 7/32 Tinned Copper
Insulation: FOAM-FLUORO
Jacket: Low Smoke PVC, White
Shield: ALUM/POLYESTER
Nom OD: 0.134 in
UL Style: CMP/CL2P
UL Flame Test: NFPA 262
CSA Flame Test: FT-6
Voltage: 300 V
Color Code: Black, White
RoHS Complaint: Yes
P/N Basis: Olympic 2944LT-12

Cable B
No of Conductors: 2
Conductor Size: 18 AWG
Stranding: 7/26 Bare Copper
Insulation: Low Smoke PVC
UL Style: CMP/CL2P
UL Flame Test: NFPA 262
CSA Flame Test: FT-6
Voltage: 300 V
Color Code: Black, White
RoHS Complaint: Yes
PN Basis: Olympic 2202

CAMERA CABLES

Category 6A cables per section 271000

2.10 VIDEO SURVEILLANCE

2.11 VIDEO MANAGEMENT SYSTEM SOFTWARE LICENSING

A. Shall be Provided, installed and Commissioned by Rowan.

2.12 IP DEVICES (CAMERAS)

B. This contractor shall provide, install, terminate, and test Category 6A cables meeting all the requirements of section 27100 for each camera. Cable shall be terminated on the punch-down blocks in the IDF and to a surface-mount style jack above the ceiling nearby each IP Camera location.

C. IP devices (cameras) shall be provided and commissioned by Rowan, installed and aimed by contractor. Contractor shall include minimum of two (2) days of labor to re-aim and adjust cameras per Rowan's security personnel's direction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All materials and equipment shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagrams. The Installation Contractor shall furnish all conduit, wiring, junction boxes, cabinets and similar devices necessary for installation of the systems and equipment. The Installation Contractor shall furnish and install all conduit, clamps, connectors, and wiring and route such wiring through the conduit for all systems and equipment.

B. All penetrations of floor slabs, roofs, and fire walls shall be fire stopped in accordance with all local codes.

C. End of Line Devices (i.e., resistors, diodes, capacitors) shall be furnished as required and shall be installed at the field device.

D. All equipment shall be installed in the locations shown on the Contract Drawings, and in accordance with manufacturer's data and this Specification.

E. During the erection of ladders scaffolding and any elevating mechanism the Installation Contractor will exercise extreme care to avoid damage to any finishes. Any damage created by the Installation Contractor shall be repaired to original condition.

F. All equipment shall be installed using mechanical fasteners. Mounting with tape will not be acceptable.

3.4 SECURITY SYSTEM WIRING

A. Provide and install, in accordance with all applicable National, State, and local codes, the manufacturer's recommendations, and the Contract Drawings and Specifications, all equipment, wiring in conduit and outlet boxes required for erection of a complete and properly operating system. As applicable, plenum rated cable may be routed exposed above fully accessible suspended ceilings.

1. All plenum rated cable shall be suspended from the structure by approved means (i.e., D-rings). Placing plenum rated cable directly on any suspended ceiling grid or hung from other equipment or conduit shall not be permitted.

2. Connectors and couplings for all conduits shall be compression type fittings only.

3. Greenfield or flexible metal conduit shall only be used between a junction box and a field device located in a concealed area. Greenfield or flexible metal conduit may also be used between a junction box and the head end equipment rack; it shall be restricted to a maximum length of five (5) feet.

B. All cable shall be plenum rated; wire shall be color coded; and wire size, type and manufacturer shall be as cited on the Contract Drawings. All cable run in conduit: shall be color coded; and wire size, type and manufacturer shall be as cited on the Contract Drawings. Wire size and types specified are minimum and shall be increased, as required, to meet proper system operating parameters and field conditions.

1. Installation Contractor shall verify before starting a cable pull, that conduit ends are checked to ensure that bushings are in place and that no burrs or irregularities are present which might damage cables.

2. Cables and wires such as signal leads, having small conductors and low strength are particularly vulnerable to damage or breakage due to excessive tension - extreme care shall be used in installing them. The manufacturer's maximum pulling tension shall not be exceeded.

3. Cable ends extending from conduits after pulling shall be protected against mechanical damage during the interval prior to final termination, testing, and connection to equipment.

C. Terminations

1. Termination of power cables within enclosures shall include clamping fittings to provide support where required.

2. Signal cables terminated on blocks at consoles, panels and racks, and at equipment terminal boards shall be arranged with individual wires of sufficient length to permit neat forming and training from the end of the cable jacket to terminal points, allowing sufficient room for sleeves with their respective cable numbers. Nonmetallic ties and supports shall be used, as required, to provide a neat and orderly installation of good appearance.

3. Not more than two wires shall be connected to a single terminal, and where two wires are connected, the two lugs shall be placed back-to-back on the terminal stud or screw with a bare or tinned copper washer between the two to ensure proper contact, or special lugs designed for proper contact shall be used.

4. Signal cables entering panels and racks for termination shall be neatly trained and formed. Bundles shall be supported by non metallic ties from point of entry to terminating point.

D. Identification of Cables and Wires

1. All cables shall have permanent identification markers applied to each cable at the terminal ends. Permanent markers shall have a white surface with cable identification in black, and lettering shall be a minimum 1/8 inch high. The alphanumeric conductor identifications used, shall be the wire numbers shown on the Installation Contractor's prepared wiring diagrams.

3.5 CUTTING AND PATCHING

A. The Installation Contractor shall be responsible for all cutting and patching necessary for the installation of the work, after approval by the Engineer and the Architect. If the Installation Contractor, as part of the work, is responsible for placing sleeves and/or hangers and they are not placed in time or are improperly placed, the Installation Contractor shall be responsible at its expense for all resulting forming, drilling and corrective work to be done to the work and to other work, including patching.

B. All cutting, fitting, patching and drilling by the Installation Contractor shall be done promptly and so as to leave the work in condition and appearance acceptable to the Engineer and the Architect.

C. Structural members shall not be cut except by written authorization given by the Engineer and pursuant to the direction given by the Architect.

3.6 CLEAN UP

A. During and upon completion of the installation, all debris created by the Installation Contractor's installation shall be removed by the Installation Contractor from the premises of the site/facilities or disposed of as directed.

3.7 TESTING AND INSPECTION

A. The system shall be tested for final acceptance in the presence of the Engineer and Architect, Installation Contractor's representative and the security management system manufacturer's representative.

B. The following shall be tested during the Site Acceptance Testing (SAT):

1. Every card reader access control portal for proper ingress, egress, and alarm output operation.

2. The security management system field panel for proper input/output operations and communications to the head end computer system.

C. Upon successful completion of all final SATs, and before formal System Acceptance the Installation Contractor's, security management system and video system manufacturer's representatives shall each author and sign a letter confirming the successful completion of the testing. Two (2) copies of each letter shall be forwarded to the Engineer and the Architect.

D. All final SAT testing shall be conducted at a time convenient to the Engineer and the Architect, and all testing costs shall be borne by the Installation Contractor as part of this Contract.

3.8 OPERATION, MAINTENANCE AND INSTRUCTION MANUALS AND TRAINING

A. The Installation Contractor shall refer to Specification 017823-1.4.B.1 for further requirements. At a minimum, include:

1. Manufacturer's catalog pages of all installed equipment and components, all Installation Contractor installed as-built conduits, equipment internal termination drawings, and wiring diagrams for all equipment and systems.

2. Detailed index for reference.

3. Each set shall be bound within a common loose-leaf, hard back binder indexed, numbered and organized with table of contents for convenient reference.

4. Instructions shall be complete including step-by-step instructions for start-up, operation, shut down, testing, and maintenance/ troubleshooting.

3.9 WARRANTY

A. The equipment manufacturer shall directly guarantee the new system equipment for a period of two (2) years from the date of official acceptance of the system.

B. The Installation Contractor shall perform maintenance as needed on all equipment throughout a two (2) year warranty period. All such maintenance shall be performed at the Installation Contractor's sole cost and expense, including parts and labor. This shall include having the service period available on a call basis with a response within four (4) hours and repair time within two (2) hours.

END OF SECTION 280000

SECTION 284700 –FIRE ALARM SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, and Division 1 Specification Sections, apply to this and the other sections of Division 26.

B. Requirements specified in all other sections of Division 26 apply to this Section.

1.2 SUMMARY

A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.

B. Work covered by this section includes the furnishing of labor, equipment, and materials for modification of existing fire alarm system as indicated on the drawings and specifications. Owner's vendor, Wayman Fire Protection, 888-492-9626.

C. Intent is to contractor to replace all fire alarm wiring from the relocated fire alarm control panel to new, relocated, and existing fire alarm devices within the renovation area. Shop drawings should show this new wiring, including new notification zones/circuits.

D. Existing fire alarm control panel is to be relocated to the first floor electrical room. All fire alarm wiring serving existing to remain areas shall be spliced and extend to new fire alarm panel location. Shop drawings should show all existing zones and devices, for a full complete floor plans and riser diagrams of the entire system.

E. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
   1. Fire alarm and detection operations and other equipment as indicated in the drawings and specifications.
   2. Power supplies, NAC panels, and horns and strobes.
   3. SLC loop with addressable smoke, heat, and CO detectors.
   4. Addressable monitoring and control modules for: Tamper switches, flow switches, HVAC equipment duct detector monitoring & HVAC shut-down, etc.
   5. Field labeling: Each initiation and notification device shall have a clear, self-adhesive label applied that contains minimum 10 pt black lettering indicating the SLC or NAC panel loop number and address or number of the device.
   6. A final fire alarm shop drawing as-built will be required at the completion of construction. This as-built must show all devices, their address (NAC or SLC) and the wiring configuration; wiring configuration means to show the notification and initiation wiring sequence from device to device, not the actual wiring location in the building.

1.3 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the

following:
1. Edwards EST-3 (Existing fire alarm control panel)

1.4 CODES

A. The system and all associated operations shall be in accordance with the following:
1. Guidelines of the following Building Code: IBC 2021.
2. NFPA 72, National Fire Alarm Code 2019
3. NFPA 70, National Electrical Code 2020
4. NFPA 101, Life Safety Code
5. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
6. Other applicable NFPA standards
7. Local Jurisdictional Adopted Codes and Standards
8. ADA Accessibility Guidelines

1.5 SYSTEM DESCRIPTION

A. General: Provide a complete, non-coded, addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.

B. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of 100% on-site programming to accommodate system expansion and facilitate changes in operation. All programming shall be capable of being accomplished via the front panel and via a lap top computer. All software operations shall be stored in a non-volatile programmable memory within the FACP. Loss of primary and secondary power shall not erase the instructions stored in memory.

C. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. Separate alarm, supervisory and trouble logs shall be provided.

D. Wiring/Signal Transmission:
1. Transmission shall be addressable signal transmission, dedicated to fire alarm service only.
2. System connections for initiating (signaling) circuits and notification appliance circuits shall be Class A.
3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.

E. Remote Access:
1. FACP shall have the capability to provide Remote Access through a Dial-Up Service

Modem using the public switched telephone system of a private switched telephone system.

2. A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.

F. Required Functions: The following are required system functions and operating features:

1. Priority of Signals: Alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Supervisory and Trouble events have second-, and third-level priority respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
2. Noninterfering: The activation of an addressable device does not prevent the receipt of signals from subsequent activations.
3. Transmission to Remote Central Station: Automatically route alarm, supervisory, and trouble signals to a remote central station service transmitter provided under another contract.
4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and any required remote annunciators, indicating the location and type of device.
5. General Alarm: A system general alarm shall include:
   a) Indication of alarm condition at the FACP and any required remote annunciator(s).
   b) Identification of the device that is the source of the alarm at the FACP and any required remote annunciator(s).
   c) Sound all audible appliances. Audible devices shall have the ability to be silenced. The audible devices shall provide a minimum of 15 decibels above the ambient sound level.
   d) Closing doors normally held open by magnetic door holders.
   e) Unlocking designated doors.
   f) Shutting down supply and return fans serving zone where alarm is initiated.
   g) Closing smoke dampers on system serving zone where alarm is initiated.
   h) Initiation of smoke control sequence.
   i) Notifying the local fire department.
   j) Initiation of elevator recall in accordance with ASME/ANSI A17.1, when specified sensors are activated.
6. Supervisory Operations: Upon activation of a supervisory device such as fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:
   a) Activate the system supervisory service audible signal and illuminate the LED at the FACP and the remote annunciator.

b) Pressing the Supervisory Acknowledge key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.

   c) Record the event in the FACP historical log.

d) Transmission of supervisory signal to remote central station.

7. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.

8. System Reset

   a) The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."

   b) Should an alarm condition continue, the system will remain in an alarmed state.

9. Drill: A manual evacuation (drill) switch shall be provided to initiate an alarm on the FACP.

10. Manual Control: Manual controls shall be supervised so that an "off normal" position of any switch shall cause an "off normal" system trouble. The "off normal" status shall be clearly identified in plain-language on the FACP alphanumeric display.

    a) Manual Bypass Control: The ability to perform a manual bypass of selected automatic functions shall be provided.

    b) Circuit Enable/Disable Control: The system shall have provisions for disabling and enabling each circuit individually for maintenance or testing purposes.

11. WALKTEST: The system shall have a one person test feature. Enabling the one person test feature at the FACP shall activate the "One Person Testing" mode of the system as follows:

    a) The city circuit connection and suppression release circuits shall be bypassed for the testing group.

    b) Control relay functions associated to the testing group shall be bypassed.

    c) The FACP shall indicate a trouble condition.

    d) The alarm activation of any initiation device in the testing group shall cause the audible notification appliances to sound a code to identify the device.

    e) The control panel shall automatically reset itself after signaling is complete.

    f) Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.

G. Duct Smoke Detector: Activation of a duct smoke detector shall initiate a supervisory alarm at the system control panel and at the remote annunciator. Duct smoke detector activation shall also initiate an air handler unit shutdown as required by NFPA 90A.

H. Audible Alarm Notification: By horns in areas as indicated on drawings.

I. Power Requirements
1. The control panel shall receive AC power via a dedicated circuit breaker.
2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 5 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control panel.
4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control panel. A green "power on" LED shall be displayed continuously while incoming power is present.
5. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be indicated at the control panel.
6. The system shall support 100% of addressable devices in alarm operated at the same time, under both primary (AC) and secondary (battery) power conditions.
7. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

1.6 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 01 Specification Sections.
1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
2. Wiring diagrams from manufacturer.
3. Shop drawings: Provide shop drawings showing equipment/device locations and connecting wiring of entire fire alarm system. Include wiring and riser diagrams, the candela values for all strobes and full battery & voltage drop calculations for the system.
4. System Power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per all applicable standards.
5. Provide copies of NICET Level II Fire Alarm certifications for at least two (2) technicians assigned to this project.
6. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of SLC, NAC, RAC, Sensor, and auxiliary control circuits.
7. Operating instructions for FACP.

8. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
9. Record of field tests of system.
10. Record Shop Drawings: A final fire alarm mass notification shop drawing as-built will be required at each building at the completion of construction. This as-built must show all devices, their address (NAC or SLC) and the wiring configuration; wiring configuration means to show the notification and initiation wiring sequence from device to device, not the actual wiring location in the building. The goal is to have an accurate shop drawing showing how the fire alarm and mass notification system is wired in the building.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A factory authorized installer is to perform the work of this section.

B. The equipment and installation supervision furnished under this specification is to be provided by a manufacturer who has been engaged in production of this type (software driven) of equipment for at least ten (10) years, and has a fully equipped service organization with the ability to respond and address concerns on site within the same day of notice.

C. The system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760-23.

D. Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects with fire alarm systems work similar to that required for this project. At least one NICET Level 2 technician shall be on site at all times during the fire alarm installation. The installer shall have a NICET Level 3 technician visit the site at least one time per week during the fire alarm installation to review and approve the installation.
   1. Firm with manufacturer’s factory trained personnel.
   2. Firm with factory authorized service organization and spare parts stock.
   3. All control equipment must have transient protection devices to comply with UL 864 requirements. In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760-23.

E. Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

1.8 EXTRA MATERIALS

A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:
   1. Manual Stations & Lexan Covers: Furnish quantity equal to 5 percent of the number

of manual stations and covers installed, but not less than two.

2. Strobe Units: Furnish quantity equal to 5 percent of the number of units installed, but not less than two. Separate attic stock shall be provided for wall and ceiling devices.
3. Speaker/Strobe Units: Furnish quantity equal to 5 percent of the number of units installed, but not less than two. Separate attic stock shall be provided for wall and ceiling devices.
4. Smoke, Carbon Monoxide and Heat Detectors: Furnish quantity equal to 5 percent of the number of units of each type installed but not less than two of each type.
5. Sensor Bases: Furnish quantity equal to 2 percent of the number of units of each type installed but not less than two of each type.
6. Addressable Monitoring Devices and Control Modules: Furnish quantity equal to 2 percent of the number of units of each type installed but not less than two of each type.

1.9 WARRANTY

A. The Contractor shall provide the Owner with a 2-year warranty on all materials, labor and systems from the date of Substantial Completion. The date of Substantial completion will be as set in a letter issued by the Architect – no exceptions.

B. During the course of the 2-year warranty period, the contractor shall provide a full service contract, including all labor and materials. In addition, the contractor shall provide full NFPA 72 required testing and maintenance services during the 2-year warranty period including semi-annual and annual NFPA-72 testing and certification requirements. NFPA 72 testing and maintenance certified reports shall be submitted to the Owner for record.

PART 2 – PRODUCTS

2.1 SYSTEM

A. Auxiliary Field Power Supply

1. The auxiliary power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.
2. The power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.
3. The power supply shall provide four individually addressable Notification Appliance Circuits that shall be configured as two Class "A" circuits. All circuits shall be power-limited per UL 864 requirements.
4. The power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.

5. The power supply shall operate on 120 or 240 VAC, 50/60 Hz.
6. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the SLC shall be transmitted between 24 VDC, 5 VDC and 0 VDC at approximately 3.33k baud.
7. The power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
8. The power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of eight or sixteen hours shall be Dip-switch selected.
9. The power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
10. Each of the power supply's four output circuits shall be DIP-switch selected for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
11. The power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
12. When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
13. When selected as a Notification Appliance Circuit, the output circuits of the power supply shall have the option to be coded by the use of a universal zone coder.
14. The power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple power supplies shall be a single unshielded, twisted pair wire.
15. An individual or multiple interfaced power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

B. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.

4. Point Read: The system shall be able to display or print the following point status diagnostic functions:
    a) Device status
    b) Device type
    c) Custom device label
    d) View analog detector values
    e) Device zone assignments
    f) All program parameters
5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
6. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
7. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
9. Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.
10. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:
    a) Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
    b) Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
    c) All devices tested in walk test shall be recorded in the history buffer.
11. Waterflow Operation

a) An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display, turn on all programmed notification appliance circuits and shall not be affected by the signal

silence switch.

12. Supervisory Operation

    a) An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

13. Signal Silence Operation

    a) The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.

14. Non-Alarm Input Operation

    a) Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

15. Combo Zone

    a) A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

16. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.

C. Digital Alarm Communicator/Transmitter (DACT):
1. Fire Alarm Network via fiber optic cabling shall be required for reporting to the Middle School FACP, which has the campus central station monitoring. Coordinate final requirements with existing campus fire alarm communications protocols. Connect to campus system via fiber optic cabling.

2.2 COMPONENTS

A. Intelligent Devices — General: Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Each device shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller. Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and supervision by location. Setting a device's address by physical means shall not be necessary.

B. Intelligent Detectors — General: The System Intelligent Detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires shall be

eliminated by digital filters. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable. Each detector shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and analog loop controller. Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total analog loop response time for detectors changing state shall be 0.5 seconds. Each detector shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication with the analog loop controller. A red LED shall flash to display alarm status. The detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient “Environmental Thresholds” approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminates as well as detector aging. The process shall employ digital compensation to adapt the detector to both 24-hour long term and 4-hour short-term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the “learned” base line sensitivity. The base line sensitivity information shall be updated and permanently stored at the detector approximately once every hour. The intelligent analog detectors shall be suitable for mounting on any Signature Series detector mounting base.

C. Fixed Temperature/Rate of Rise Heat Detector/Combination Heat and CO Detector, SIGA2-HRS, SIGA2-HCOS: Provide intelligent combination fixed temperature/rate-of-rise heat detectors SIGA-HRS. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135oF (57oC) and a rate-of-rise alarm point of 15oF (9oC) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications. Where shown on the project plans, include SIGA2-HCOS combination Heat and Carbon Monoxide (CO) detector. The combination Heat and CO device shall report separately to the control panel where a heat condition is considered a fire alarm and a CO condition is a supervisory alarm with separate and unique evacuation sequence.

D. Photoelectric Smoke Detector, SIGA2-PS: Provide intelligent photoelectric smoke detectors SIGA2-PS. The analog photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the

analog loop controller for retrieval using a laptop PC or the SIGA-PRO Signature

Program/Service Tool. The photo detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centers and be suitable for wall mount applications. The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide with air velocities up to 5,000 ft/min. (0-25.39 m/sec) without requiring specific duct detector housings or supply tubes. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photo detector shall be suitable for operation in the following environment: Temperature: 32oF to 120oF (0oC to 49oC), Humidity: 0-93% RH, non-condensing, Elevation: no limit.

E. Duct Detector Housing, SIGA-SD: Provide model SIGA-SD Low profile intelligent addressable DUCT smoke detector as indicated on the project plans. Provide for variations in duct air velocity between 100 and 4,000 feet per minute and include a wide sensitivity range of .79 to 2.46%/ft. Obscuration. Include one Form-C shut down relay rated 2.0 amps @ 30 Vdc and also include slave high contact relays if required. Provide an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. The addressable DUCT housing shall be suitable for extreme environments, including a temperature range of –20 to 158 degrees F (-29 to 70 degrees Celsius) and offer a harsh environment gasket option. Provide Remote Alarm LED Indicators SIGA-LED and/or remote test station model SD-TRK as indicated on the project plans.

F. Intelligent Modules — General: It shall be possible to address each Intelligent Signature Series module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment: Temperature: 32oF to 120oF (0oC to 49oC), Humidity: 0-93% RH, non-condensing.

G. Single Input Module, SIGA-CT1 (Waterflow Detectors, Tamper Switches etc.): Provide intelligent single input modules SIGA-CT1. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The single input module shall support the following circuit types: Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.), Normally-Open Alarm Delayed Latching (Waterflow Switches), Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.), Normally-Open Active Latching (Supervisory, Tamper Switches).

H. Dual Input Module, SIGA-CT2: Provide intelligent dual input modules SIGA-CT2. The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½" deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The dual input module shall support the following circuit types: Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.), Normally-Open Alarm Delayed Latching (Waterflow Switches), Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.), Normally-Open Active Latching

(Supervisory, Tamper Switches).

I. Single Input Signal Module, SIGA-CC1: Provide intelligent single input signal modules SIGA-CC1. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own “ring tone”. The module shall be suitable for mounting on North American 2 ½” (64mm) deep 2-gang boxes and 1 ½” (38mm) deep 4” square boxes with 2-gang covers, or European 100mm square boxes. The single input signal module shall support the following operations: Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A).

J. Control Relay Module, SIGA-CR: Provide intelligent control relay modules SIGA-CR. The Control Relay Module shall provide one form “R” dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on North American 2 ½” (64mm) deep 1-gang boxes and 1 ½” deep 4” square boxes with 1-gang covers.

K. Intelligent Manual Pull Stations — General: It shall be possible to address each Signature Series fire alarm pull station without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The manual stations shall have a minimum of 2 diagnostic LEDs mounted on their integral, factory assembled single or two stage input module. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The station shall be capable of storing up to 24 diagnostic codes that can be retrieved for troubleshooting assistance. Input circuit wiring shall be supervised for open and ground faults. The fire alarm pull station shall be suitable for operation in the following environment: Temperature: 32oF to 120oF (0oC to 49oC), Humidity: 0-93% RH, non-condensing.

L. Manual Pull Station, SIGA-270: Provide intelligent single action, single stage fire alarm stations SIGA-270. The fire alarm station shall be of metal construction with an internal toggle switch. Provide a locked test feature. Finish the station in red with silver “PULL IN CASE OF FIRE” English lettering. The manual station shall be suitable for mounting on North American 2 ½” (64mm) deep 1-gang boxes and 1 ½” (38mm) deep 4” square boxes with 1-gang covers.

M. Notification Appliances – General: All appliances shall be UL Listed for Fire Protective Service. All strobe appliances or combination appliances with strobes shall be UL 1971 and ULC S526 Listed. All appliances shall be of the same manufacturer as the Fire Alarm Control Panel (NO EXCEPTIONS) specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturers’ instructions. Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from THE CONTROL PANEL MANUFACTURER clearly stating that the control equipment (as submitted) is 100% compatible with the submitted Notification Appliances.

N. Strobes, G1RF-VM Series: Provide EST Series G1RF-VM series low profile wall mounted strobes at the locations shown on the drawings. Strobes shall provide synchronized flash outputs. Strobe output shall be field selectable as indicated on the drawings in one of the following intensity levels; 15, 15cd, 30cd, 75cd or 110cd. Low profile strobes shall mount in a North American 1-gang box or surface mounted on a

matching back box provided by the manufacturer, as directed in the field.

O. Horns and Horn/Strobes, Genesis Series: Provide audible horn devices as manufactured by EST, Cat. No. G1RF-HDVM Genesis Series. Screw terminals shall be provided for wiring and the speaker housings shall be RED and include "FIRE" labeling. Horns shall mount in a North American 4” electrical box with extension ring using the 2 screws provided with ring. It must not be necessary to completely remove the screws to facilitate mounting.

P. Multi-Voltage Control Relays, MR-200 Series: Provide remote control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be DPDT and rated for 10 amperes at 115 Vac. A single relay may be energized from a voltage source of 24 Vdc, 24 Vac, 115 Vac, or 230 Vac. A red LED shall indicate the relay is energized. A metal enclosure shall be provided.

Q. Electromagnetic Doorholders – General: Electromagnetic doorholders submitted for use must have written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.

R. Wall Mounted, 1504/1505/1508/1509 Series: Provide flush, semi-flush or surface wall mounted electromagnetic doorholder/releases rated at 24 Vac/dc as directed by the Consulting Engineer. Finish shall be brushed zinc.

S. STI Stopper II Lexan Guards: Manual pull stations that are provided with STI Stopper II lexan guards shall include non-audible alarms as required on the plans. They shall be surface or flush mounting, as required for each individual device. Stopper Covers shall only be included on devices shown on the plans to include them.

2.3 MISCELLANEOUS MONITORING

A. Provide addressable monitoring control module and wiring to HVAC units, as shown on drawings for shutdown of equipment upon smoke detection activation in building.

2.4 OTHER DETECTION SYSTEMS

A. CO and combination CO/Smoke detectors: Where shown on the drawings, provide and install a carbon monoxide or a combination carbon monoxide/smoke detector. Detectors shall be addressable and similar to the addressable detectors specified above.

2.5 BATTERIES

A. The battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.

B. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

C. If necessary to meet standby requirements, external battery and charger systems may be used.

PART 3 – EXECUTION

3.1 INSTALLATION, GENERAL

A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
1. Factory trained and certified personnel.
2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
3. Personnel licensed or certified by state or local authority.

3.2 EQUIPMENT INSTALLATION

A. Furnish and install a complete Fire Alarm & Voice Evacuation System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

B. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.

C. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

D. Label all fire alarm devices with the initiation circuit and device number as well as the notification circuit and device number. All labeling shall exactly match the as-built shop drawings, which shall be submitted with the O&M manuals.

E. Each of the following types of devices or equipment shall be provided with supervised circuits as shown on the drawings but shall be typically as follows:
1. Sprinkler Valve Supervisory Switches: Provide one (1) supervisory module circuit for each sprinkler valve supervisory switch.
2. When waterflow and tamper switches exist at the same location, provide one (1) dual input addressable module. When odd numbers of devices exist at a single location, provide additional single input addressable modules.

F. Each of the following types of alarm notification appliances shall be circuited as shown on the drawings but shall be typically as follows:
1. Audible Signals: Provide sufficient spare capacity to assure that the addition of five (5) audible devices can be supported without the need for addition control components (power supplies, signal circuit modules, amplifiers, batteries, etc.)
2. Visual Signals Provide sufficient spare capacity to assure that the addition of three (3) visual devices can be supported without the need for addition control components (power supplies, signal circuit modules, batteries, etc.)

3.3 WIRING INSTALLATION

A. System Wiring: Wire and cable shall be MC cable type FPLP and shall be acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC). Refer to Division 26 Section “Low Voltage Electrical Power Conductors and Cables” for acceptable locations for type MC cable vs. individual conductors in raceway – provide fire alarm wiring in conduit in Boiler Rooms, penthouses, electrical rooms, sprinkler rooms, public areas with exposed ceilings, above non-accessible ceilings, in block walls, and the like.
   1. Standard FPLP or FPLR cabling shall not be used. See MC cable FPLP requirements above.

B. Each addressable analog loop shall be circuited so device loading is not to exceed 80% of loop capacity in order to leave for space for future devices. The loop shall have Class A operation. Isolation protection between every 50 devices is not required, as it is removed in NFPA 72 2016.

C. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable sizes and types (shielded and non-shielded) to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

D. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Paint fire alarm system junction boxes and covers red.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
   1. Factory trained and certified.
   2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
   3. International Municipal Signal Association (IMSA) fire alarm certified.
   4. Certified by a state or local authority.
   5. Trained and qualified personnel employed by an

organization listed by a national testing laboratory for the servicing of fire alarm systems.

C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.

H. Final Test, Certificate of Completion, and Certificate of Occupancy:
1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

3.5 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.

B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.6 TRAINING

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 4 hours' training.

2. Schedule training with the Owner at least seven days in advance.

END OF SECTION 284700

SECTION 31 10 00 - SITE CLEARING

PART 1 - PRODUCTS

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Temporary erosion and sedimentation control.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Disconnecting, capping or sealing, removing site utilities and abandoning site utilities in place.
6. Removing existing above and below-grade site improvements.

B. Related Requirements: Section 312000 - Earth Moving, for determining satisfactory soil material.

1.03 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other non-soil materials.
D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at the Project site.

1.05 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.06 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.
C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.07 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.08 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify New Jersey - One Call (1-800-272-1000) for area where Project is located before site clearing.
D. Do not commence site clearing operations until temporary erosion and sedimentation control and plant protection measures are in place.
E. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.01 MATERIALS

F. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

2.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Install hay bales or Type II sediment logs as that produced by Curlex, an American Excelsior Company or approved equal.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.
B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and as required by the Gloucester County Soil Conservation District.
B. The contractor shall install silt fence in areas that such item can be installed properly and on paved areas along the inside perimeter of the construction fence.
C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.03 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than five days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

C. Excavate for and remove underground utilities indicated to be removed.
D. Removal of underground utilities is included in earthwork sections.

3.04 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.05 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.06 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

3.07 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them in accordance with NJDEP.
B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subbase course and base course for asphalt paving.
7. Subsurface drainage backfill for walls and trenches.
8. Excavating and backfilling trenches for utilities and pits for buried utility structures.
9. Excavating well hole to accommodate elevator-cylinder assembly. The contractor shall perform all excavations and provide the appropriate demarcations in accordance with the environmental documents where it is felt that contaminated soils might be encountered. The construction documents further delineate areas and depths where contaminated soils have been capped. Disturbance of these areas are known and are marked on the environmental plans. All waste shall be legally disposed in accordance with NJDEP.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

1.03 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation. Any backfilling shall be done with Certified Clean Materials as outlined in the environmental documents and as detailed on the construction documents.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.
H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.04 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct pre-excavation conference at the Project site.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
   a. Personnel and equipment needed to make progress and avoid delays.
   b. Coordination of Work with utility locator service.
   c. Extent of trenching by hand or with air spade.
   d. Field quality control.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches.
2. Warning Tape: 12 inches long; of each color.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.
B. Material Test Reports: For each soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 1557.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.07 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.08 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction. Provide detour and trailblazer signing that clearly instructs pedestrians and motorists around work zones.

B. Utility Locator Service: Notify NJ One Call 1-800-272-1000 for area where Project is located before beginning earth-moving operations.
C. Do not commence earth-moving operations until temporary site fencing and erosion and sedimentation control measures specified in Section 311000 "Site Clearing" are in place.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials certified “clean” when sufficient satisfactory soil materials are not available from excavations.
B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Liquid Limit: 17 - 30
2. Plasticity Index: 1 - 10.

C. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
G. Sand: ASTM C 33/C 33M; fine aggregate.

2.02 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:

a. Grab Tensile Strength: 157 lbf; ASTM D 4632.
b. Sewn Seam Strength: 142 lbf; ASTM D 4632.
c. Tear Strength: 56 lbf; ASTM D 4533.
d. Puncture Strength: 56 lbf; ASTM D 4833.

3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
4. Permittivity: 0.2 per second, minimum; ASTM D 4491.
5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 4 inches wide and 5 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.03 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials. Where contaminated soils are encountered, refer to the environmental documents for disposal or use protocol.

3.04 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

3.05 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades. Any excavation outside the property line is to be treated as being of contaminated soilsmaterials. Proper excavation and disposal and demarcations is to be followed in accordance with the environmental documents and construction details.

3.06 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: As indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. All utility installation outside the property lines shall be considered as being in contaminated soils. All trenching shall have the placement of, certified clean fill and demarcation boundary in accordance with the construction plans and environmental documents. All excess soils shall be handled and disposed of in a manner consistent with the environmental documents

3.07 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.
B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
C. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.08 UNAUTHORIZED EXCAVATION

E. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.09 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.
B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
D. Backfill voids with satisfactory soil while removing shoring and bracing.
E. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

F. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

G. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch .
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase[and base] layer to not less than 95percent of maximum dry unit weight according to ASTM D 1557.

3.17 FIELD QUALITY CONTROL

A. Special Inspections: Special inspections are as required by the 2009 IBC NJ Edition. Special inspections are for work supporting building structure and utilities more than 12” deep. The CM shall coordinate with the Owner’s qualified special inspectors to perform, as a minimum, the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.
G. All other inspections and tests not called out above or as required by the IBC shall be performed by the contractor, at the contractor’s expense.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
B. Repair and reestablish grades to the specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, determine the cause of the settling and correct as necessary and backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 312316.13 – TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating trenches for utilities from 5 feet outside building to utility service.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Backfilling and compaction.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Sections:
1. Section 311000 – Site Clearing.
2. Section 312000 – Earth Moving
3. Section 312200 – Grading
4. Section 334211 – Stormwater Conveyance.

C. American Association of State Highway and Transportation Officials:
1. AASHTO T180 – Standard Specification for Moisture–Density Relations of Soils Using a 4.54–kg (10–lb) Rammer and a 457–mm (18–in.) Drop.

D. ASTM International:
1. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft–lbf/ft3 (600 kN–m/m3).
2. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand–Cone Method.
3. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft–lbf/ft3 (2,700 kN–m/m3).
4. ASTM D2167 – Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 – Standard Test Method for Density of Soil and Soil–Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

A. Section 013300 – Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. Product Data: Submit data for geotextile fabric indicating fabric and construction.

D. Samples: Submit, in air–tight containers, 10 lb. sample of each type of fill to testing laboratory.

E. Materials Source: Submit name of imported fill materials suppliers.

F. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NJDCA and the Borough of Glassboro.

B. Maintain one copy of document on site.

1.6 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in New Jersey.

1.7 RELATED DOCUMENTS

A. Verify field measurements prior to fabrication.

1.8 COORDINATION

A. Section 013100 – Project Manager and Coordination, and project conditions.

B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.
1. Architect/Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser–beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

A. Contact the NJ One Call at 8–1–1 or 800-272-1000 not less than three, but no more than ten business days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.

D. Protect benchmarks, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right–of–way. Obtain all necessary permits to perform work within the public right–of–way. Relocate controls and reroute traffic as required during progress of Work.

3.3 TRENCHING

A. Excavate subsoil required for utilities to utility service.

B. Remove lumped subsoil, boulders, and rock up of 1/6 cu. yd., measured by volume. Remove larger material as specified in Section 310000 – Earth Moving.

C. Perform excavation within 24 inches of existing utility service in accordance with utility company's requirements.

D. Do not advance open trench more than 200 feet ahead of installed pipe.

E. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.

F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.

G. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and utilities.

H. Do not interfere with 45 degree bearing splay of foundations.

I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. Slope excavation at a maximum slope of 2 horizontal to 1 vertical. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.

J. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Architect/Engineer until suitable material is encountered.

K. Cut out soft areas of subgrade not capable of compaction in place. Backfill with clean sand or sand and gravel with a maximum gravel size of 1.5–inches and compact to density equal to or greater than requirements for subsequent backfill material.

L. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Architect/Engineer.

M. Stockpile subsoil in area designated on site to depth not exceeding 20 feet and protect from erosion.

3.4 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be left in place as part of the completed Work, cut off minimum 18 inches below finished grade.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Place fill material in continuous layers and compact in accordance with Section 310000 – Earthwork.

D. Employ placement method that does not disturb or damage utilities in trench.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Do not leave more than 50 feet of trench open at end of working day.

G. Protect open trench to prevent danger to the public.

3.6 TOLERANCES

A. Top Surface of Backfilling: Plus or minus 1 inch from required elevations.

3.7 FIELD QUALITY CONTROL

A. Perform laboratory material tests in accordance with ASTM D1557.

B. Perform in place compaction tests in accordance with the following:
1. Density Tests: ASTM D1556.
2. Moisture Tests: ASTM D3017.

C. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

3.8 PROTECTION OF FINISHED WORK

A. Reshape and re–compact fills subjected to vehicular traffic during construction.

END OF DOCUMENT 312316.13

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SECTION 312350 – SAWCUTTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes the saw-cutting of existing concrete and bituminous pavement and footway at the locations indicated on the plans.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections:
1. Section 312000 – Earth Moving
2. Section 321200 – Aggregate Base Course
3. Section 321216 – Asphalt Paving
4. Section 321600 – Concrete Curbs, Gutters, Sidewalks, and Driveways
5. Section 033053 – Miscellaneous Cast-in-Place Concrete

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. In accordance with NJDOT Specifications for Roadway and Bridge Construction.

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SECTION 31 25 00 - EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section specifies requirements for the construction and maintenance of various, temporary soil erosion and sediment control measures, including relocation as required for staged construction.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) ASTM C 33 Specification for Concrete Aggregates.

1.03 REQUIREMENTS

A. Environmental Requirements

1. Apply dust retardants other than water only when wind velocity is less than 5 mph and drift hazard is negligible.
2. Use Dust Retardant or other approved methods for temporary surface stabilization of short duration where establishing grass by seeding is not practical.

B. Construction Requirements

1. The Contractor shall employ soil erosion and sedimentation control measures during the duration of the contract to control erosion and minimize the sedimentation of water courses on the construction site.
2. The Contract Drawings do not include borrow pits or storage areas that the Contractor utilizes or establishes outside of the site in order to perform the Work. If the land disturbance for this Work is five thousand square feet (5,000 SF) or greater, the Contractor shall provide the Engineer with documentation that a soil erosion and sediment control plan has been approved for this Work by the Gloucester County Soil Conservation District.
3. The Contractor shall incorporate all permanent pollution control features into the project at the earliest practicable time. Temporary soil erosion and sediment control measures shall be coordinated with the permanent pollution control features and with the construction of pavement, drainage facilities such as pipes, culverts, headwalls, channels, ditches, etc., to the maximum extent practical to assure economical, effective and continuous erosion control throughout the duration of the Contract, as outlined in the approved progress schedule.
4. Prior to all grubbing operations, soil erosion and sediment control measures shall be installed. When unstabilized areas caused by site development, grading, or other earth disturbing activities exist beyond 14 calendar days, the areas disturbed shall be seeded and mulched. These requirements pertain to perimeter controls, berms, dams, swales, ditches and slopes. Upon completion of the grading or construction, disturbed areas shall be permanently stabilized in accordance with the Contract Drawings within 7 calendar days.
5. When excavation or embankment construction reaches the finished subgrade, those areas on which paving is to be placed are exempt from the above stabilization requirements. Roadways and haul roads actively being used for daily conveyance of

equipment as well as areas between temporary berms, except median areas, are also exempt unless otherwise shown on the Contract Drawings.

6. Streams shall be protected from soil erosion and sediment. Streams being diverted shall be protected through the use of silt fences. Temporary diversion channels shall be lined with geotextile and temporary riprap.
7. The turbid discharge from dewatering construction activities shall be contained in a dewatering basin in order to control sediment and provide filtration of water prior to it being released into adjacent streams or other watercourses.
8. Soil being stockpiled shall be placed in well-drained areas no closer than 50 feet from streams, wetlands, floodplains and other watercourses, unless otherwise directed by the Engineer. The stockpiles shall be seeded and mulched in accordance with the Contract Drawings. Temporary soil erosion and sediment controls shall be provided around the stockpiles until such time as vegetation is established on the piles.
9. Temporary soil erosion and sediment control measures shall be used to correct conditions that develop during construction.
10. In the event that temporary soil erosion and sediment control measures are required due to the Contractor's failure, for any reason, to install or maintain soil erosion and sediment controls, either as part of the work or as directed by the Engineer, such Work shall be performed by the Contractor at no additional cost to the Owner.
11. If the Contractor is not in compliance with soil erosion and sediment control provisions, corrective actions shall be taken immediately. The Engineer may suspend the Work, wholly or in part, until such time as the Contractor is fully in compliance. All corrective and remedial work required to bring the Contractor into compliance shall be performed at no additional cost to the Owner.
12. Temporary soil erosion and sediment control measures shall be removed when necessary to allow for the installation of permanent control features or as permanent controls become functional. Before issuance of a Certificate of Final Completion, all items used for temporary soil erosion and sediment control shall be removed unless otherwise shown on the Contract Drawings.

1.04 SUBMITTALS

Submit catalog cuts for the following:

A. Geotextiles
B. Dust Retardant
C. Submit certificate from geotextile manufacturers that geotextiles comply with the requirements specified in this Section.
D. Submit documentation of approval of soil erosion and sediment control plan for offsite land disturbance greater than 5000 square feet.

1.05 DELIVERY, HANDLING AND STORAGE

A. Protect materials against damage prior to installation.

1.06 SPARE MATERIALS

A. During construction, the Contractor shall have on hand sufficient spare materials and appurtenances as are necessary to repair damage to permanent and temporary installations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Geotextiles shall conform to the Section entitled "Geotextiles". Unless otherwise shown on the Contract Drawings, geotextiles shall have a maximum Apparent Opening Size of 0.6 mm. and minimum permeability of 1 x 10-3 cm/sec.
B. Silt Fences and Inlet Filter Sediment Control shall be "Self Supported".
C. Geotextiles for other Soil Erosion and Sedimentation Control items shall be "Erosion Control - Class A".
D. Wood stakes, posts and boards shall be solid, reasonably knot-free lumber conforming to the nominal size specified on the Contract Drawings.
E. Hay bales shall consist of timothy, red top or native grasses securely bound with wire or baling twine. The twine shall be an ultra-violet light stabilized polypropylene which has a knot strength of 170 pounds and straight break strength of 300 pounds.
F. Rip rap shall be broken stone (argillite, calcite, dolomite, gneiss, granite, quartzite, traprock). Unless otherwise shown on the Contract Drawings, riprap shall have a designated median stone (D50) size in the range of 6 to 9 inches maximum dimension, weighing not more than 150 pounds, with at least 90% weighing more than 25 pounds but not more than 40% exceeding 100 pounds, having the following characteristics:

Characteristic	Max. %
Weathered decomposed stone	5
Other than that classification approved	5
Absorption in cold water	1.8
Sodium sulfate soundness, loss by weight	10

G. Coarse aggregate shall be broken stone or washed crushed gravel meeting the specification for rip rap except for size and weight requirements. Size and gradation shall be as shown on the Contract Drawings.
H. Welded wire fabric shall conform to AASHTO M55 flat sheets or rolls.
I. Pipe for temporary slope drains shall be minimum 8-inch diameter of type shown on the Contract Drawings.
J. Topsoil Stabilization Matting. Topsoil stabilization matting shall be one of the following:

1. Excelsior mat shall be wood excelsior, 48 + 1 inch in width and weighing 0.8 pounds per square yard, + 5 percent. The excelsior material shall be covered with a netting to facilitate handling and to increase strength and shall be biodegradable.
2. Jute mat shall be cloth of a uniform plain weave of undyed and unbleached single jute yarn, 48 + 1 inch width and weighing an average of 1.2 pounds per linear yard of cloth with a tolerance of + 5 percent, with approximately seventy-eight warp ends per width of cloth and forty-one weft ends per linear yard of cloth. The yarn shall be of a loosely twisted construction having an average twist of not less than 1.6 turns per inch and shall not vary in thickness by more than one half its normal diameter.

K. Dust Retardant

1. "Coherex" as manufactured by Golden Bear Division of the Witco Corporation, Chandler, AZ 85244.
2. "Soil-Sement" as manufactured by Midwest Industrial Supply, Inc., Canton, OH 44711.
3. "Soil Seal Concentrate" as manufactured by Soil Seal Corporation, Los Angeles, CA 90017.
4. Or approved equal.

L. Calcium Chloride shall be Grade 2, in the form of loose dry granules or flakes, and shall be fine enough to feed through commonly used spreaders at the specified rates.

2.02 CONSTRUCTION FEATURES

A. Silt Fence

1. Silt fence shall consist of geotextile whose width shall be at least 3 feet to provide for a 2-foot high fence after 1 foot of fabric is buried in the existing soil. Heavy-duty silt fence shall consist of geotextile whose width shall be at least 4 feet to provide for a 3 foot high fence after 1 foot of fabric is buried in the existing soil. Sections of fabric shall be joined in such a manner that, when in operation, the sections work effectively as a continuous fence. Fence posts shall be installed at a slight angle toward the anticipated runoff source.
2. Heavy-duty silt fence shall include a welded wire mesh backing for the geotextile. This welded steel wire mesh shall be galvanized and contain 4 inch square openings. The geotextile shall be secured to the welded wire mesh.

B. Dewatering Basin

1. Dewatering basins shall be constructed within the Site and outside any undisturbed wetland area, and areas not affected by roadway construction, as a dewatering containment measure in order to control sediment and provide filtration of water.
2. The dewatering basins shall be sized by the Contractor to entirely contain the expected discharge of water and sediment based on the flow rate of the pump to be used and the volume of water present within the area to be dewatered. The material to be used to form the basin is at the discretion of the Contractor. The outfall of the basin shall be such that the water exiting the basin does not cause erosion to, or scouring of, the area onto which the water is being discharged.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clearing and grubbing operations shall be so scheduled and performed that grading, mulching, seeding and other permanent pollution control features can follow immediately thereafter according to the approved progress schedule. Should seasonal limitations make such coordination unattainable, additional temporary soil erosion and sediment control measures shall be performed between successive construction stages, as directed.
B. The amount of surface area of erodable earth material exposed at one time by clearing and grubbing, excavation, borrow or fill operations, without stabilization, shall not exceed 750,000 square feet for clearing and grubbing operations, or 750,000 square feet for grading operations without prior approval. The Engineer may increase or decrease these amounts commensurate with the Contractor's ability to keep the construction on the approved progress schedule.

3.02 INSTALLATION

A. Embankment Areas

1. Side ditches shall be excavated and stabilized, and perimeter soil erosion and sediment controls installed, before beginning all earth work. Stabilization for the ditches and swales shall consist of seed, mulch, topsoil stabilization matting or temporary riprap, as required to prevent erosion.
2. Embankment greater than 25 feet in height shall be stabilized in stages of equal increments not to exceed 15 feet. Each stage shall be either temporarily seeded and mulched, or permanently stabilized, before proceeding with the next stage. At the

completion of the final stage of embankment placement, the entire slope, if not previously done, shall be permanently stabilized.

3. At the end of each workday, temporary stabilized earth berms and slope drains shall be constructed along the top edges of the embankment to intercept surface runoff.

B. Excavation Areas

1. Ditches to be used in a cut section, and side and outlet ditches, shall be excavated and stabilized, and perimeter soil erosion and sediment controls installed, before beginning all earthwork. Stabilization for the ditches shall consist of seed, mulch, topsoil stabilization matting or temporary riprap, as required to prevent erosion.
2. Slopes greater than 25 feet in height shall be excavated and stabilized in stages of equal increments not to exceed 15 feet. Each stage shall be permanently stabilized before proceeding with the next stage, in accordance with the time limitations specified herein.

C. Dust Control

1. Employ construction methods and means that keep flying dust to a minimum. Provide for the laying of water or other dust control materials on the project and on roads, streets and other areas immediately adjacent to the project limits, and wherever traffic or buildings that are occupied or in use are affected by such dust caused by his hauling or other construction operations. The materials and methods used for dust control shall be as specified herein or as directed by the Engineer.
2. Apply Dust Retardant in accordance with the manufacturer's written instructions. Reapply as often as required. Calcium chloride shall not be used in any areas to be seeded or landscaped.
3. Calcium chloride may only be used on pavement subgrades subject to the approval of the Engineer. Care shall be exercised when using calcium chloride on steep slopes to prevent the calcium chloride from washing into streams or accumulating around plants or in landscape areas. Calcium chloride shall not be applied in solution. Apply calcium chloride at a rate of approximately 1.5 pounds per square yard.

D. Dirt Control

1. The Contractor shall provide for prompt removal from existing roadways of all dirt and other materials that have been spilled, washed, tracked or otherwise deposited thereon by his hauling and other operations, whenever the accumulation is sufficient to cause the formation of mud, interfere with drainage, damage pavements or create a traffic hazard.
2. In order to minimize tracking of dirt and other materials onto existing roadways, a stabilized construction driveway shall be constructed at locations where vehicles exit a work site. The construction driveway shall consist of a layer of broken stone, which shall be a minimum 4 inches thick and 40 feet long where practical, and of sufficient width to serve the intended purpose. The broken stone shall be 2 1/2 - inch nominal size conforming to ASTM C-33 size No. 2. The driveway shall be maintained by top dressing with additional stone, as directed, and shall be removed when no longer required.

3.03 SOIL EROSION AND SEDIMENT CONTROL MAINTENANCE

A. Soil erosion and sediment control measures shall be maintained during the Contract even when the Work is suspended. Controls shall be inspected immediately after each rain, and any required corrective work shall immediately be performed. Riprap stones, coarse aggregate, silt fence, or haybales damaged due to washouts or siltation shall be replaced.

B. Sediment traps and basins shall be cleaned out when they are 50 percent filled. Silt fences, stone outlet structures, dams, and haybales shall have sediment removed when the sediment reaches 50 percent of the height of the soil erosion and sediment control measure. Sediment removed shall be disposed of in accordance with the Contract Drawings.

END OF SECTION 312500

SECTION 32 12 00 - AGGREGATE BASE COURSE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This item consists of a base course composed of crushed aggregates constructed on a prepared course for roadway or footway pavements and curbs in accordance with these specifications and in conformity to the dimensions and typical cross sections shown on the plans.

1.03 RELATED SECTIONS

A. Section 312000 - Earth Moving.
B. Section 321216 - Asphalt Paving.
C. Section 321400 - Unit Paving.
D. Section 321600 - Concrete Curbs, Sidewalks, and Driveways

PART 2 - PRODUCTS

2.01 AGREGATE

A. Soil Aggregate I-3 meeting 2019 NJDOT Specifications for Roadway and Bridge Construction Section 901.11.

PART 3 - EXECUTION

3.01 PREPARING UNDERLYING COURSE

A. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected at the Contractor's expense before the base course is placed thereon. Material shall not be placed on frozen subgrade.
B. The underlying course shall be prepared in accordance with NJDOT Updated Specifications for Roadway and Bridge Construction Section 301.03.01(A).

3.02 MIXING

A. The aggregate shall be uniformly blended during crushing operations or mixed in a plant. The plant shall blend and mix the materials to meet the specifications and to secure the proper moisture content for compaction.

3.03 PLACING

A. Placement of the aggregate or subbase course shall be performed in accordance with NJDOT Updated Specifications for Roadway and Bridge Construction Section 301.03.01(B).

3.04 COMPACTION

A. Compaction and density of the aggregate or subbase course shall meet the requirements of NJDOT Updated Specifications for Roadway and Bridge Construction Section 301.03.01(C).

3.05 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY

A. Aggregate base course shall be accepted for density on a lot basis. A lot will con-sist of one day's production where it is not expected to exceed 2400 square yards. A lot will consist of one-half day's production where a day's production is expected to consist of between 2400 and 4800 square yards.

B. Each lot shall be divided into two equal sublots. One test shall be made for each sublot. Sampling locations will be determined by the Engineer on a random basis in accordance with statistical procedures contained in ASTM D 3665.

C. Each lot will be accepted for density when the field density is at least 98 percent of the maximum density of laboratory specimens prepared from samples of the base course material delivered to the job site. The specimens shall be compacted and tested in accordance with ASTM D 1557. The in-place field density shall be determined in accordance with ASTM D 1556 or D 2922. If the specified density is not attained, the entire lot shall be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached.

D. In lieu of the core method of field density determination, acceptance testing may be accomplished using a nuclear gage in accordance with ASTM D 2922. The gage should be field calibrated in accordance with paragraph 4 of ASTM D 2922. Calibration tests shall be conducted on the first lot of material placed that meets the density requirements.

E. Use of ASTM D 2922 results in a wet unit weight, and when using this method, ASTM D 3017 shall be used to determine the moisture content of the material. The calibration curve furnished with the moisture gages shall be checked as de-scribed in paragraph 7 of ASTM D 3017. The calibration checks of both the density and moisture gages shall be made at the beginning of a job and at intervals as determined by the Engineer.

F. If a nuclear gage is used for density determination, two random readings shall be made for each sublot.

3.06 FINISHING

A. In no case will the addition of thin layers of material be added to the top layer of base course to meet grade. If the elevation of the top layer is 1/2 inch or more be-low grade, the top layer of base shall be scarified to a depth of at least 3 inches, new material added, and the layer shall be blended and recompacted to bring it to grade. If the finished surface is above plan grade, it shall be cut back to grade and rerolled.

END OF SECTION 321200

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. New Jersey Department of Transportation specifications.

1.02 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.

1.03 Related Requirements:

A. Section 312000 - Earth Moving for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
B. Section 321200 - Aggregate Base Course

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
   a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
   b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.
2. Job-Mix Designs: NJDOT Plant and job mix Certification for asphalt base course and surface course.
3. Asphalt Paving Geotextile Fabric.

1.06 INFORMATIONAL SUBMITTALS

A. Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.
B. Qualification Data: For manufacturer and testing agency.
C. Material Certificates: For each paving material. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.
D. Material Test Reports: For each paving material, by a qualified testing agency.
E. Field quality-control reports.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by NJDOT qualified products list (QPL).
B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the 2019 Standard Specifications of NJDOT for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.

PART 2 - PRODUCTS

2.01 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.
B. Coarse Aggregate: Meeting NJDOT Updated Specifications for Roadway and Bridge Construction Section 901.05.01.
C. Fine Aggregate: Meeting NJDOT Updated Specifications for Roadway and Bridge Construction Section 901.05.02.
D. Mineral Filler: Meeting NJDOT Updated Specifications for Roadway and Bridge Construction Section 901.05.03.
E. Reclaimed Asphalt Pavement (RAP): Meeting NJDOT Updated Specifications for Roadway and Bridge Construction Section 901.05.04.

2.02 ASPHALT MATERIALS

A. Asphalt Binder: Meeting NJDOT Updated Specifications for Roadway and Bridge Construction Section 902.01.01.
B. Asphalt Cement: Meeting NJDOT Updated Specifications for Roadway and Bridge Construction Section 902.02.
C. Prime Coat: Meeting NJDOT Updated Specifications for Roadway and Bridge Construction Section 901.01.03.
D. Tack Coat: Meeting NJDOT Updated Specifications for Roadway and Bridge Construction Section 901.01.01.
E. Water: Potable.

2.03 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material from sources and gradations that have

performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Sand: ASTM D 1073 or AASHTO M 29, Grade No. 2 or No. 3.
C. Joint Sealant: Meeting NJDOT Updated Specifications for Roadway and Bridge Construction Section 914.02.
D. Geotextile Asphalt Paving Fabric: Meeting AASHTO M 288.

2.04 MIXES

A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not more than 25 percent by weight.
B. Hot-Mix Asphalt Base Course: 19M64.
C. Hot-Mixed Asphalt Surface Course: 9.5M64

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.
B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.02 UTILITY TRENCH PATCHING

A. Asphalt Base Course (if encountered under brick street pavers during utility installations): Remove brick pavers and setting bed. Saw cut pavement full depth. Cut and excavate faces vertically. Install utility and back fill as detailed on the plans. Place and compact aggregate base course to form new subgrade. Place and compact new base course to the same thickness as encountered. Reinstall brick pavers utilizing the same materials and thicknesses as discovered.
B. Portland Cement Concrete Base Course (if encountered under brick street pavers during utility installations):

1. Remove brick pavers and setting bed. Saw cut pavement full depth. Cut and excavate faces vertically. Install utility and back fill as detailed on the plans. Place and compact aggregate base course to same lift thickness as encountered to form new subgrade. Place new portland cement concrete base course to the same thickness as encountered. Reinstall brick pavers utilizing the same materials and thicknesses as discovered.

C. Tack Coat: Before placing asphalt material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal/sq yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.03 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Spread mix at a minimum temperature of 250 deg F.
3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
5. After the base course has been placed, and prior to placement of asphalt paving fabric, spray tack coat over the surface in accordance with the manufacturers recommendation then lay down the asphalt paving fabric in accordance with the manufacturer's recommendation.
6. Place the hot mixed asphalt top course to line and grade.

B. Place paving in consecutive strips not less than 8 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface. Paving operations of the base course pavement shall be contiguous and be completed in one work shift.

3.04 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Compact asphalt at joints to a density within 2 percent of specified course density.

3.05 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

    1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

    1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent or greater than 100 percent.
    2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
E. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.06 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

    1. Base Course: Plus or minus 1/8 inch.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

    1. Base Course: 1/4 inch.
    2. Surface Course: 1/8 inch.
    3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: As required by 2009 IBC NJ edition, chapter 17, the Owner will engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil and the imported soil. All remaining testing by shall be performed by the contractor.
B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
D. Retain "Asphalt Traffic-Calming Devices" Paragraph below only for site-formed, asphalt traffic-calming devices.
E. Revise methods of verifying field compaction if using Superpave mix-design system. Consult state or local DOT for methods that have been successfully used.
F. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.

    1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
    2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
        a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
        b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

G. Replace and compact hot-mix asphalt where core tests were taken.
H. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.08 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan as required in Division 01.

END OF SECTION 321216

SECTION 32 16 00 - CONCRETE CURBS, GUTTERS, SIDEWALKS AND DRIVEWAYS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. New Jersey Department of Transportation specifications.

1.02 SUMMARY

A. Section Includes:

1. Concrete Curb.
2. Concrete Sidewalks.
3. Concrete Driveways.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
B. Other Action Submittals:

Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer of detectable warnings, ready-mix concrete manufacturer and testing agency.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Applied finish materials.
6. Bonding agent or epoxy adhesive.
7. Joint fillers.

C. Retain first paragraph below for material test reports that are Contractor's responsibility.
D. Material Test Reports: For each of the following:

1. Aggregates.

E. Retain paragraph below if Contractor is responsible for field quality-control testing and inspecting.
F. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

G. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

H. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
I. ACI Publications: Comply with ACI 301 unless otherwise indicated.
J. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete paving subcontractor.

1.07 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
K. The installation of sidewalks, curbs and other paved areas shall follow the Remedial Action Workplan and construction details.

PART 2 - PRODUCTS

2.01 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
L. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.02 STEEL REINFORCEMENT

A. In accordance with NJDOT Updated Specifications for Roadway and Bridge Construction Section 905.01.

2.03 WELDED WIRE REINFORCEMENT

A. In accordance with NJDOT Updated Specifications for Roadway and Bridge Construction Section 905.01.03.

2.04 CONCRETE MATERIALS

A. In accordance with NJDOT Updated Specifications for Roadway and Bridge Construction Section 903.03.

2.05 MORTAR

A. In accordance with NJDOT Updated Specifications for Roadway and Bridge Construction Section 903.08.01.

2.06 CURING MATERIALS

A. In accordance with NJDOT Updated Specifications for Roadway and Bridge Construction Section 903.10.

2.07 PREFORMED JOINT FILLER

A. In accordance with NJDOT Updated Specifications for Roadway and Bridge Construction Section 914.01.

2.08 HOT-POURED JOINT SEALER, TYPE 2

A. In accordance with NJDOT Updated Specifications for Roadway and Bridge Construction Section 914.02.

2.09 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4,000 psi or as specified on the plans.

2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.

3. Slump Limit: 4 inches, plus or minus 1 inch.

M. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

.

1. Air Content: 6 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.

N. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

O. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture, high-range, water-reducing and retarding admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

P. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

Q. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
R. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
S. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
T. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
U. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

V. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.05 JOINTS

A. Coordinate joint types, descriptions, and locations with Drawings. Construction, isolation, and contraction joints and edging have been consolidated in this article for consistency rather than for strict sequence of installation.
W. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
X. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

Y. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
7. Expansion joints in the heavy-duty pavements and driveways shall be accompanied with the inclusion of #4 stainless steel dowels, 18” long as detailed on the construction plans.

Z. Terms "contraction joint" and "control joint" have been used interchangeably in the past. ACI documents use the term "contraction joint." Revise description in first paragraph below if the term "control joint" is preferred.

AA. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes.
    a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

BB. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement and joint devices.

CC. Screed paving surface with a straightedge and strike off.

DD. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

EE. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

FF. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

GG. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

HH. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.08 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.09 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: As required by 2009 IBC NJ edition, chapter 17, the Owner will engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil and the imported soil. All remaining testing by shall be performed by the contractor.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each **100 cu. yd.** or fraction thereof of each concrete mixture placed each day.

a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

A. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
B. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
C. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
D. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

E. Concrete paving will be considered defective if it does not pass tests and inspections.
F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
G. Prepare test and inspection reports.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with Portland cement concrete bonded to paving with epoxy adhesive.
C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321600

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This work shall consist of establishing the location of roadway pavement markings and installing reflectorized pavement markings of the specified color and size on specified pavements in accordance with these specifications, at the locations shown on the plans, or as directed by the Engineer.

B. Additional work covered under this section includes the layout and painting of parking stripes, roadway legends, and handicapped accessibility international symbols and cross-walk stripes.

C. This Section includes establishing the location and installation of the following re-flector-ized thermoplastic pavement markings on the specified pavements in ac-cordance with these specifications:

1. 24" White Hot Thermoplastic Pavement Markings
2. 4" White Hot Thermoplastic Pavement Markings

PART 2 - PRODUCTS

2.01 CERTIFICATION

A. The Contractor shall furnish manufacturer's certified test reports for materials shipped to the project. The certified test reports shall include a statement that the materials meet the specification requirements. The reports can be used for mate-rial acceptance or the Engi-neer may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the Engi-neer upon arrival of a shipment of materials to the site.

2.02 PAVEMENT MARKINGS

A. Hot Thermoplastic Pavement Marking materials shall meet the requirements identified in New Jersey Standard Specifications for Road and Bridge Constriction Section 610.

PART 3 - CONSTRUCTION

3.01 WEATHER LIMITATIONS

A. The painting shall be performed only when the surface is dry and when the sur-face tem-perature is between 50 and 90 degrees Fahrenheit, the pavement sur-face temperature is at least 5 degrees Fahrenheit above the dew point, and the wind speed is less than 20 miles per hour. Painting operations shall be discontinued when the surface temperature exceeds the paint manufacturer’s recommendations.

3.02 EQUIPMENT

A. Equipment shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, a bead and/or silica sand dispensing machine, and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the job.

3.03 PREPARATION OF SURFACE

A. The road surface shall be cleaned and pretreated as required for material adhesion prior to installation.

B. Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other foreign material that would reduce the bond between the paint and the pavement. The area to be painted shall be cleaned by sweeping and blowing or by other methods as required to remove all dirt, laitance, and loose materials.

C. Paint shall not be applied to Portland cement concrete pavement until the areas to be painted are clean of curing material. Sandblasting or high-pressure water shall be used to remove curing materials.

D. Paint shall not be applied to bituminous pavements until the areas to be painted are clean and have been in place for at least 7 days.

3.04 LAYOUT OF MARKINGS

A. The proposed markings shall be laid out in advance of the paint application. The locations of markings to receive glass beads shall be as follows, or as shown on the plans: 24” White Pavement Markings for crosswalks.

B. Glass beads shall not be applied to black outline paint markings or temporary markings as designated by the Engineer.

3.05 APPLICATION

A. Apply Pavement markings as specified in New Jersey Standard Specifications for Road and Bridge Constriction Section 610.

3.06 BORDER

A. A 6-inch wide outline border of nonreflectorized black paint is required around all permanent pavement markings placed on concrete pavement.

3.07 PROTECTION

A. After application of the paint, all markings shall be protected from damage until the paint is dry. All surfaces shall be protected from excess moisture and/or rain and from disfiguration by spatter, splashes, spillage, or drippings of paint.

3.08 TEMPORARY PAVEMENT PAINTING

A. Markings may be required for phasing operations or before paving operations are complete. Temporary markings may be placed at least 50 percent of the specified application rate specified for permanent markings. Black border paint is not required for temporary pavement marking.

3.09 PAINT REMOVAL

A. Remove markings by water blasting. Submit and obtain acceptance for the method to be used, prior to commencement of work. Removal of existing pavement markings by painting over with black paint, by milling or by shot blasting is not acceptable. Removal methods shall be employed that will cause the least damage to pavement structure or pavement surface. Satisfactorily repair any pavement or surface damage caused by the removal methods. Pavement markings to be removed shall be at locations shown on the plans or as designated by the Engineer as operations require.

B. Prior to commencement of the work, the contractor shall submit and obtain ap-proval of the proposed method of paint removal. The Engineer reserves the right to require a demon-stration of the proposed method prior to removal.

END OF SECTION 321723

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Excavation for fence post bases

2. Concrete anchorage for posts

3. Installation of chain link fences

4. Installation of chain link gates

1.02 REFERENCES

A. Comply with ASTM A 53 for requirements of Schedule 40 piping.

1.03 DEFINITIONS

A. Height of Fence: Distance measured from the top of the concrete footing to the top of the fabric, see drawings for fence heights.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's name, specifications and installation instructions for each item specified.

B. Shop Drawings: Complete detailed drawings for each height and style of fence and gate required. Include separate schedule for each, listing all materials required and technical data such as size, weight and finish to ensure conformance to the specifications.

C. Quality Control Submittals

1. Qualifications Certification: Submit written certification or similar documentation signed by the applicable subcontractor, prime contractor and/or manufacturer (where applicable) indicating compliance with the "Qualifications" requirements specified below in the "Quality Assurance" section of this specification.

2. Experience Listing: Submit a list of completed projects using the products proposed for this project, including owner's contact information and telephone number for each project, demonstrating compliance with applicable "Qualifications" requirements specified in the "Quality Assurance" section of this specification.

1.05 QUALITY ASSURANCE

A. Comply with the standards of the Chain Link Fence manufacturer's Institute, including (unless otherwise indicated):

1. Specification for Metallic Coated Steel Chain Link Fence Fabric

2. Specification for Vinyl Coated Steel Chain Link Fence Fabric

3. Industrial Steel Specification for Fence Rails, Posts, Gates and Accessories

4. ASTM F-567 - Standard Practice for Installation of Chain Link Fence for installation unless otherwise indicated on the Contract Documents.

B. Qualifications

1. Provide metal fences and gates as a complete unit produced by a single manufacturer, including necessary erection accessories, fitting and fasteners. Products shall be provided by a company specializing in commercial quality chain link fencing with at least five years' experience.

C. Regulatory Requirements

1. Obtain written permission from applicable agencies prior to the start of construction. Submit one copy of the permit as specified in "Submittals-Quality Control Submittals" above.

D. Mockups: Build mockups to set quality standards for fabrication and installation.

1. Include 10 foot length of fence and gate section.

1.06 PROJECT CONDITIONS

A. Field Measurements: Establish and maintain required lines and elevations for grade control.

1.07 SEQUENCING AND SCHEDULING

A. Proceed with and complete chain link fence and gate installation as rapidly as portions of the site become available, working within seasonal limitations for the work required.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Framework Standards

1. Steel Pipe: Cold rolled steel pipe meeting the requirements of ASTM A-569 with minimum yield strength of 50,000 psi.

2. Interior Coating: In line applied zinc rich coating with zinc powder loading of a minimum 90% by weight applied after fabrication conforming to ASTM B 6 high grade and Special High Grade Zinc.

3. Exterior Coatings

a. Base Coat: Minimum .9 ounces zinc per square foot.

b. Intermediate Coat: Minimum 15 microgram chromate conversion per square inch.

c. Top Coat: Minimum 0.3 mil cross link polyurethane acrylic exterior coating.

d. Black vinyl exterior coating.

4. Size of Pipe: As indicated on Construction Drawings.

B. Framework and Footings

1. End Posts, Corner Posts or Terminal Posts

a. Pipe: 2-1/2” O.D.

b. Set pull posts at the midway point of all lines 500 feet or longer and at all changes of direction or grade of 15 degrees or more. Place pull posts at each radius point within the curved line where the internal angle is 30 degrees or more.

c. Footing Size: ≥ 10.0” O.D. by 3’-6” deep.

2. Line Posts

a. Pipe: 2.0” O.D.

b. Space line posts at a maximum of 10 feet on center unless specifically noted otherwise on the contract documents.

c. Footing Size: ≥ 8.0” O.D. by 3’-0” deep.

3. Gate Posts

a. Pipe: 3.0” O.D.

b. Gate opening: 42”

c. Footing Size: ≥ 12.0” O.D. by 3’-0” deep.

4. Gate Framework and Footings for Gate: Height indicated on drawings

a. Pipe: 3.0” O.D. unless specifically noted otherwise on the Contract Documents.

b. Set pull posts at the midway point of all lines 500 feet or longer and at all changes of direction or grade of 15 degrees or more. Place pull posts at each radius point within the curved line where the internal angle is 30 degrees or more.

c. Footing Size: ≥ 12.0” O.D. by 3’-6” deep.

C. Post Brace: Provide manufacturer’s standard adjustable brace at gate posts and at both sides of corner and pull posts, with a horizontal brace located at the mid-height of the fabric.

D. Top and Bottom Rails

1. 1-5/8” O.D. pipe, weighing 1.84 pounds per linear foot. Install rails in the manufacturer’s longest lengths utilizing expansion couplings, approximately 6” long at each joint.

2. Provide means for attaching the top rail securely to each gate post, corner post, pull post and end post.

a. Provide bottom rail for all fences.

E. Swing Gate Posts

1. As noted on Drawings.

F. Swing Gate Framework

1. As noted on Drawings.

2. Assemble gate frames by welding. Provide truss rods as cross bracing to prevent sag or twist.

G. Swing Gate Hardware

1. Hinges: Non-lift type, offset to permit 180 degree swing and of a suitable size and weight to support the gate.

2. Latch: Forked type for single gates. Drop bar type with keeper for double gates and single gates over 10 feet wide complete with flush plate set in concrete. Drop bar length shall be 2/3 the height of the gate. A padlock eye shall be an integral part of the latch construction.

H. Chain Link Fabric: Height indicated on drawings

1. Fence: Black Vinyl Coated Fabric: provide 2” mesh, 9 gauge steel wires, with one piece fabric widths. The coating is to be fused and adhered to galvanized wire in accordance with Federal Specifications RR-F-191 H/ID, ASTM F-668 Class 2B, and ASTM F934. Coating thickness to be 7 mils.

2. Gate: Galvanized wire, 2” mesh, 9 gauge Steel Wires with one piece fabric widths.

a. Manufacturer: As described

3. Selvages: Top and bottom selvages to be knuckled.

I. Post Caps:

1. Weather tight closure cap, one cap per post.

2. Furnish caps with openings to permit passage of rail.

3. Fasteners: Tamper resistant cadmium plated steel screws.

4. Vinyl Coated: Black

J. Stretcher Bars: One piece equal to the full length of the fabric, minimum cross section 1/4” by 3/4”

K. Metal Bands (for securing stretcher bars): Steel, wrought iron or malleable iron.

L. Hardware: Self-locking bands, tie wires and similar accessories.

1. Vinyl Coated Hardware: Black

M. Wire Ties: PVC finish complying with ASTM A809, 0.40 ounces per square foot.

1. For tying fabric to line posts, rails, and braces: 9 gauge steel wire installed at 12” O.C.

2. For tying tension wire to fabric: 11 gauge steel hog rings at 24" O.C.

3. All wire ties shall be double-wrapped.

N. Truss Rods: 3/8" diameter.

O. Bolts and Nuts: ASTM A 307, Grade A

P. Concrete: Portland cement concrete having a minimum compressive strength of 3,000 psi at 28 days.

Q. Cold Galvanizing Compound: Single component compound giving 93% pure zinc in a dried film and meeting the requirements of DOD-P-21035A (NAVY)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer Verification of Conditions: Examine conditions under which chain link fences and gates are to be constructed with the materials and components specified in this section. Affected Prime Contractors, the Owner's Representative and the Architect shall be notified in writing of any conditions detrimental to the proper and timely installation of the work.

1. When the installer confirms conditions as being acceptable to ensure proper and timely installation of the work and to ensure requirements of applicable warranties or guarantees can be satisfied, submit written confirmation to the Architect. Failure to submit written confirmation and subsequent installation will be assumed to indicate conditions are acceptable to the installer.

3.02 PREPARATION

A. Clear and grub plant material along the fence line as required to eliminate growth interfering with the fence alignment. Remove all debris from the project property.

B. Do not begin installation of the fence until finish grading in area has been completed.

3.03 INSTALLATION

A. Space posts equidistant in the fence line at a maximum of 10 feet on center unless specifically noted otherwise on the Contract Documents.

B. Setting Post in Earth: Drill holes for fence footings. Set posts in the center of the hole and fill the hole with concrete below finish grade. Plumb and align posts, vibrate or tamp concrete for consolidation. Do not attach fabric to posts until the concrete has cured a minimum of seven days.

C. Located corner posts at corners and at changes in direction. Use pull posts at all abrupt changes in grade and at intervals no greater than 500 feet. On runs over 500 feet, space pulls posts evenly between corner or end posts. On long curves, space pulls posts so that the strain of the fence will not bend line posts.

D. Install top rail continuously through post tops or extension arms, bending to radius for curved runs. Install expansion couplings as recommended by the fencing manufacturer.

E. Install bottom and intermediate rails in one piece between posts and flush with the post on the fabric side using special offset fittings where necessary.

F. Brace corner posts, pull posts, end posts and gate posts to adjacent line posts with horizontal rails.

G. Diagonally brace corner posts, pull posts, end posts and gate posts to adjacent line posts with truss rods and turnbuckles.

H. Attach the fabric to the active playfield or security side of the fence. Maintain a 1 inch clearance above the finished grade except where indicated otherwise. Thread stretcher bars through the fabric using one bar for each gate and end post and two for each corner and pull post. Pull fabric tight so that the maximum deflection of the fabric is 2 inches when a 30 pound pull is exerted perpendicular to the center of a panel. Maintain tension by securing stretcher bars to posts with metal bands spaced at 15” O.C. Fasten fabric to steel framework with wire ties spaced 12” O.C. for line posts and 24” O.C. for rails and braces. Bend back wire ends to prevent injury. Tighten stretcher bar bands, wire ties and other fasteners securely.

I. Position bolts for securing metal bands and hardware so nuts are located opposite the fabric side of the fence. Tighten nuts and cut off excess threads so no more than 1/8” is exposed. Peen ends to prevent loosening or removal of nuts. Secure post tops and extension arms with tamper resistant screws.

J. Install gates plumb and level and adjust for full opening without interference. Install ground set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricate where necessary.

K. Wire brush and repair welded and abraded areas with one coat of cold galvanizing compound.

L. Restore disturbed ground areas to their original condition. Topsoil and seed to match adjacent areas.

3.04 ADJUSTING AND CLEANING

A. Repairs and Protection of chain link fences and gates.

1. Repair or replace broken or defective chain link fences and gates as directed by the Architect.

2. Protect chain link fences and gates from damage until acceptance of the fencing construction.

END OF SECTION 323113

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SECTION 32 39 14 - FIXED BOLLARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This item shall consist of permanent, non-removable steel pipe bollards with concrete bases as shown on the Contract Plans, or as directed by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Bollards shall be minimum 6-inch diameter.

B. Bollards shall extend minimum 48 inches above finished grade.

C. Bollards shall be constructed of steel in accordance with ASTM A36.

D. Color chips for fixed bollards shall be presented to the Borough for approval.

E. Concrete footings for bollards shall be constructed with 3,000 psi concrete within a minimum 36-inch-long by minimum 18-inch diameter sonotube.

1. Concrete footings for bollards shall minimum extend 36 inches below finished grade.

PART 3 - EXECUTION

3.01 NOT USED

END OF ITEM 323914

SECTION 32 91 00 - PLANTING PREPARATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Extent of work is shown on Drawings and includes but is not limited to:

1. Planting Soil for grass areas including handling and use of stockpiled topsoil.
2. Preparation of subgrade and finish grade and compaction mitigation.
3. Clean up.

1.03 RELATED REQUIREMENTS

A. Division 31 Earthwork
B. Section 329219 Seeding
C. Section 329200 Turf and Grasses
D. Section 329300 Plants

1.04 REFERENCES

A. The following apply to work in this Section:

1. Agricultural Chemist: Qualified, experienced public or private soils testing laboratory, capable of providing test results as specified.
2. ASTM: American Society of Testing Materials.
3. USDA: United States Department of Agriculture.
4. AOAC: Association of Official Agricultural Chemists.
5. SSSA: Soil Science of America, Methods of Soil Analysis.
6. TMECC: Test Methods for the Examination of Composting and Compost.

1.05 GENERAL DEFINITIONS

A. Finish Grade: Elevation of finished surface of Planting Soil.
B. Topsoil: A native mineral soil taken from the O and A Horizons of a well-drained site and having a USDA soil texture classification as specified herein.
C. Planting Soil: Imported Topsoil amended as necessary to meet material requirements herein.
D. Subgrade: Surface or elevation of subsoil remaining after completing excavation immediately beneath Planting Soil.

1.06 SUBMITTALS

A. Qualifications

1. Installation and maintenance foreman on the job shall be experienced in landscape installation and maintenance on projects with similar scope. Perform work with personnel totally familiar with Planting Soil preparation

and lawn and planting installations under the supervision of a foreman experienced with landscape work.

2. Testing Laboratory: Experienced person or persons employed by public or private testing laboratory, qualified and capable of performing tests, making soil recommendations, and issuing reports as specified. The Testing Laboratory shall submit a Statement of Qualifications with regard to the specified testing. The Testing Laboratory shall be approved by the Owner and Landscape Architect.
3. Soil Supplier and Installing Contractor shall be experienced in fabrication and installation of soil mixes with similar complexity.

B. Sequencing, Scheduling and Protection Plan

1. Submit a detailed plan for scheduling and sequencing of all soil work including but not limited to rough grading, Planting Soil installation, fine grading, equipment data and settlement/compaction methodology.
2. Coordinate all soils work with Contractors requiring access through the site.
    i. Indicate with schedules and plans the utilization of Planting Soil and subsoil protection measures until Substantial Completion.
    ii. Indicate with schedules and plans protection measures (wooden protection boards or other approved methods) over areas where construction operations will traverse installed Planting Soil.

C. Samples, Product Data and Certificates

1. Samples: Submit loose materials in sealed bags labeled with the name of the project title, material, manufacturer/supplier.
    i. Topsoil, 1-gallon re-sealable plastic bag.
    ii. Organic amendment, 1-gallon re-sealable plastic bag.
    iii. Sand, 1-gallon re-sealable plastic bag.
    iv. Soil amendments or conditioners as recommended by soil testing agency to correct deficiencies or bring soil within compliance of specifications. Submit certificates and product data cut sheets for each type of amendment material.
    v. Planting Soil, 1-gallon re-sealable plastic bag.
2. Provide written confirmation that the source of supply can meet the quantities required for the scope of work. Multiple sources for a single item are not acceptable.
3. Quality Control Samples: Maintain a 5-gallon bucket of final approved Planting Soil and Compost on-site in a protected, secure location. If the installed or delivered Planting Soil or Compost deviate from the control samples additional testing will be required at the Contractors expense.

D. Soil Testing

1. Prior to delivery to the site, submit all required soil materials to an approved soil testing laboratory and test as defined herein.
2. Planting Soil test reports shall be submitted for review and approval prior to delivery to the site.
3. If required to bring Planting Soil into Specification conformance, Sand amendment shall be tested. Test reports shall be provided for review and

approval to verify amendment conformance prior to blending of Sand with Topsoil.

4. Compost shall also be submitted for testing to verify conformance with Specifications. If required to bring Planting Soil into Specification conformance, Compost amendment test reports shall be submitted for review and approval to verify amendment conformance prior to blending of Compost with Topsoil.
5. Submit Compost test reports for review and approval prior to performing the in-situ Compost amendment.
6. The contractor shall coordinate testing, submittal review, and fabrication allowing enough time to complete the testing and review process, Planting Soil fabrication within the construction timeline and without impacting the schedule.
7. An A2LA Accredited Lab shall perform all soil testing. Submit the testing laboratory credentials for review and approval prior to submitting materials for testing. Utilize a single approved testing laboratory unless approved otherwise or indicated otherwise herein.
8. All test results and samples shall be submitted to the Landscape Architect for review and approval.
9. Test results of samples shall conform to the specifications, or specific soil amendments shall be proposed for approval.
10. All Test Reports must be labeled with the following information.
    i. Date material sampled from source/supplier.
    ii. Date material tested in lab.
    iii. Project title.
    iv. Name of contractor.
    v. Name of source/supplier and material tested.
    vi. Testing agency name and contact information.
    vii. Test type and test result including units reported.
    viii. Results of test including deviations from acceptable ranges as defined by the specifications. If not defined by the specifications then as recommended by the testing agency.
    ix. Test reports must be submitted with sample of the material tested.
11. Test Reports: Submit this specification and sample intended for use for Planting Soil or in-situ Compost amendment to the approved Testing Agency. All reports must be submitted with representative samples. Provide test reports indicating results inclusive of all criteria specified in Part 2 herein.

1.07 PROJECT CONDITIONS

A. Environmental Requirements for Soil:

1. Perform on-site soil work only during suitable weather conditions. Do not disc, roto-till, or work soil when frozen, excessively wet or muddy, or in otherwise unsatisfactory condition.
2. Planting Soil shall not be handled, hauled or placed during rain or wet weather when over-compaction will occur.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Planting Soil and organic amendment materials shall be protected from intrusion of contaminants and erosion at all times. Once mixed, cover the final stockpile with filter cloth or store in a covered space.
B. Soil materials shall not be delivered to the site until samples and test reports have been approved by the Landscape Architect. However, such approval does not constitute final acceptance of Planting Soil.
C. Stockpiling: On-site stockpiling shall be restricted to no more than the needs of what can be used in a 24 hour period, unless approved otherwise by the Landscape Architect. Stockpiles should be no more than 6 feet in height to prevent anaerobic conditions within the pile(s). Composts should be turned weekly.
D. Deliver packaged materials to the location where soils are to be mixed, in unopened bags or containers, each bearing the name, guarantee, and trademark or the producer, material composition, manufacturer's certified analysis, and the weight or the material. Retain packages for review by the Landscape Architect.
E. Store and handle packaged materials in compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, and theft.

PART 2 - PRODUCTS

2.01 PLANTING SOIL

A. All Planting Soils shall meet the requirements stated below. The primary component of the Planting Soil shall be Topsoil. The soil supplier may make adjustments to the Planting Soil with Organic Amendments and Sand as necessary and in conformance with the material requirements specified herein.

    1. Organic Amendments and/or Sand amendments shall be homogenously blended and uniformly mixed with Topsoil using a mechanical soil blender designed for such purpose or shall be uniformly mixed by wind-rowing.
    2. Topsoil that is to be blended with Sand must be screened or shredded before mixing with Sand.
    3. Soil materials must be maintained moist, not wet, during mixing.
    4. Compost may not be added greater than 20% by volume.
    5. Topsoil shall be a natural, loamy, friable mineral soil taken from the O and A Horizons essentially free from heavy or stiff clay lumps, stones, cinders, concrete, brick, roots, sticks brush, litter, plastics, metals, refuse or other deleterious materials in accordance with ASTM D 5286-92. The soil shall be free of herbicides, petroleum-based materials or other substances of a hazardous or toxic nature, which may inhibit plant growth. The soil shall be free of noxious weeds, seeds or vegetative parts of weedy plants that cannot be selectively controlled in the planting.

B. All Planting Soil types shall meet all the requirements listed herein and shall be a fertile, natural soil, free from large stones, roots, sticks, clods, plants, peat, sod, pockets of coarse sand, pavement and building debris, glass, noxious weeds including invasive species, infestations of undesirable organisms and disease causing pathogens, and other extraneous materials harmful to plant growth. Soil shall be consistent throughout the project, and shall be obtained form the same approved source, matching approved samples. If source is changed at any time during construction, the Contractor shall obtain complete tests of new source samples and submit them to the Landscape Architect for review and approval, prior to ordering.

1. Approximate composition of planting soil:
    i. 70% topsoil, 10% organic amendment, 20% sand.
    ii. Final ratios for the Planting Soil will be determined during the submittal review process, as the composition of the topsoil, sand, and organic matter components will vary depending on the source. Planting Soil shall meet the following specifications. Perform the following tests and submit test reports showing the following criteria are met.
2. All Planting Soil shall be tested for particle size and organic content after passing through a 1/4-inch sieve rather than the standard 2-mm sieve to include larger pieces of organic material.
3. Particle Size Analysis shall be performed and compared to the USDA Soil Classification System per ASTM D422 (hydrometer test) and USDA sand and gravel classifications shall be determined on material retained on the #270 sieve following a wet washing procedure unless specified otherwise herein. Test data shall clearly indicate results in percent passing and percent retained and shall conform to the following particle size distribution:

USDA Particle Name Size (mm)	%Passing (% Oven Dry Weight)
Sand (0.05 to 2 mm)	50% - 60%
Silt (0.002 to 0.05mm)	shall not exceed 30%
Clay (less than 0.002mm)	10-20%

4. Organic content of planting soils shall have a range of three to six percent by weight (3.0 - 6.0%) as determined by ASTM F1647-11, loss-on-ignition, oven-dry weight. To adjust organic content, planting soil may be amended, prior to placing and final grading, with the addition of organic amendments as defined herein.
5. The pH of the planting soil shall have a range of 6.5 to 7.5.
6. Nutrient Analysis: shall include at a minimum macro-nutrient analysis including Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), and Sulfur (S). Test results shall be cited in parts per million. Nutrient test shall identify any deficiencies and shall make recommendations to correct deficiencies specific to the plants specified on the Drawings. The testing lab shall also provide notice when chemicals are in excessive levels and are toxic to plants, humans or animals.
7. Soluble Salt Content shall be less than 2.0 mmhos/cm (dS/m) and shall be determined by electrical conductivity of a 1:2 soil/water sample reported in millimhos per cm.
8. Cation Exchange Capacity (CEC) shall be a minimum of 12 Meq/100g and shall be determined using the pH 7 ammonium acetate method.
9. Carbon to nitrogen (C:N) ratio shall be between 10:1 and 20:1.

2.02 ORGANIC AMENDMENT

A. Organic Amendment shall conform to the following minimum characteristics as indicated on submitted test reports:

    1. Organic Amendment testing shall be done in conformance with the U.S. Compost Council's publication Test Methods for the Examination of Composting and Compost (TMECC) unless otherwise specified herein.

2. Organic amendments shall be stable, mature, weed-free, aerobically composted yard waste. Woodchip bulked bio-solids, sewage sludge, peat, peat-humus and mushroom compost products are not acceptable.
3. Organic Amendment shall be a homogenous material essentially free of soil clods, lumps, roots and stones.
4. Organic Amendment shall be a well-aged, black to dark brown color with few identifiable parts.
5. Organic Amendment shall have a man-made foreign material (hard plastics, metal, glass, etc.) content less than 1.5% as material retained on a U.S. Std. No. 5 (4 mm) sieve (TMECC 03.06).
6. Organic Amendment shall be screened such that a minimum of 90% passes a U.S. Std. 3/4" sieve and that no more than 10% passes a U.S. Std. No. 10 sieve on a dry weight basis.
7. Carbon/ Nitrogen ratio shall be less than 30:1. Optimum ratio is less than 15:1.
8. Degree of maturity: Composted organic matter shall be considered stable as determined by the Solvita compost maturity index. Compost must achieve a maturity index of at least 7 indicating a "finished compost" that is well matured, aged compost, curing grade; few limitations for usage.
9. Organic content shall be 35% minimum as determined by ASTM F1647-11, loss-on-ignition, oven-dry weight
10. pH of the finished composted organic matter shall be near 7.0, and be within the range of 6.5 to 7.5.
11. Salinity: Soluble salts shall be <3.0 mmhos/cm (dS/m) and shall be determined by electrical conductivity of a 1:2 soil/water sample reported in millimhos per cm.
12. Ammonium content: Ammonium shall be less than 400 ppm on a dry weight basis.

2.03 SAND

A. Sand amendment shall be clean, sharp, natural silica coarse Concrete Sand complying with ASTM-33 Fine Aggregate with a Fine Modulus Index between 2.8 and 3.2.

1. pH shall fall between 6.0 and 7.0.
2. Soluble salt content shall be less than 2.0 millimhos per cm and shall be determined by electrical conductivity of a 1:2 soil/water sample reported in millimhos per cm.
3. Organic matter content shall be less than 1.0%.

2.04 SOIL AMENDMENTS

A. Additional Amendments: Use only as required per soil test reports.

1. Lime shall be an approved agricultural ground, high magnesium limestone containing not less than 85% total carbonates, 95% passing a 20 mesh sieve, 40% passing a 60 mesh sieve and a minimum of 30% passing a 100 mesh sieve, and shall be applied at the rate as recommended by the soil tests. Lime shall be applied mechanically at least 2 weeks prior to planting and fertilizer applications and incorporated into full depth of Planting Soil prior to fine grading.

2. Humic Acid by the following manufacturer or approved equal:
    i. "TerraVive MHA" as manufactured by Natural Environmental Systems, www.naturalenviro.com, (800) 999-9345.
    ii. “HUMUS BIO-GRO” as manufactured by Biofix Holding, Inc. www.biofix.com (940) 382-2594.
    iii. “Humax” as manufactured by JH Biotech, Inc. www.jhbiotech.com (863) 537-1200.
3. Fertilizer shall be a complete slow-release commercial fertilizer, complying with all Federal and State fertilizer laws. Fifty percent of the fertilizer components shall be derived from natural organic sources. Fertilizer chemical make-up shall be based on the soil test recommendations by the soil-testing laboratory and shall be delivered to the site in the original unopened containers each showing the manufacturer's guaranteed analysis. Store fertilizer so that when used it shall be dry and free flowing. For bidding purposes, assume fertilizer analysis to be 20,20,20 (N,P,K).

PART 3 - EXECUTION

3.01 VERIFICATION

A. Prior to construction and soil placement operations at planting areas ascertain the location of all electric cables conduits under drainage systems and utility lines. Take proper precaution to protect sub-grade elements from disturbance or damage. Contractor failing to take these precautions shall be responsible for making requisite repairs to damaged utilities at Contractor’s own expense. Verify that required underground utilities are available, located, and ready for use. Coordinate with other trades.
B. Verify that all work requiring access through or adjacent to areas where Planting Soil is to be placed has been completed and no further access will be required. In the event that access will be required, this must be coordinated with the Contractor.
C. Any soils polluted by gasoline, oil, mortar and grout debris, construction debris, unacceptable soils, or other substances that would render the soils unsuitable for a proper plant growth shall be removed from the premises whether or not such pollution occurs or exists prior to or during the Contract period. In the event that such material is placed, this material shall be removed and replaced with approved material. All remedial operations associated with soil mixes shall be reviewed and approved by the Landscape Architect.
D. Subgrade shall be unfrozen, firm, and stable with no standing water, mud, or muck.
E. Prior to soil placement operations ascertain that subgrade conditions allow reasonable water infiltration. Report slow water infiltration to the Landscape Architect prior to proceeding with work.
F. Verify that previously installed protection measures are in place.
G. Verify that excavation and rough grading is complete.
H. Do not begin work until all other work is complete.
I. Beginning installation means acceptance of existing conditions.

3.02 EQUIPMENT

A. Utilize low-impact machines only. All equipment shall be rated for a ground pressure of 4 psi or lower. Equipment with track belts is preferred.
B. Excavation shall be performed in the dry and shall be accomplished by methods, which preserve the undisturbed state of subgrade soils. The existing subgrade shall

not be compacted or subject to excessive construction equipment prior to placement of soil materials. Use of equipment with narrow tracks or tires, rubber tires with large lugs, or high-pressure tires that will cause excessive compaction shall not be permitted within the excavation.

3.03 SITE PROTECTION

A. Protect adjacent existing and finished construction from damage or staining by the subgrade soil and Planting Soil. Use ½" plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.

1. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each working day.

B. Maintain all silt and sediment control devices required by applicable regulations.
C. Provide adequate methods to assure that trucks and other equipment do no track soil from the site onto adjacent property and the public right of way.

3.04 PREPARATION OF SUBGRADE FOR PLANTING SOIL

A. Subgrade depths are identified on Drawings. Existing grades shall be modified as necessary to fulfill this requirement even if existing grades coincide with the proposed finished grades.
B. Make thorough evaluation of the subgrade to ensure water infiltration and drainage, particularly in areas that are not receiving a subsurface drainage system. If drainage is impeded or excessively slow alert the Landscape Architect immediately for corrective measures. Do not proceed with work until remedial action as be determined and implemented.
C. Do not grade subgrade soil when muddy or excessively wet or frozen. Only work soil when friable. Adhere to environmental requirements as specified herein.
D. Clear the excavation of all construction debris, trash, rubble and any foreign material. In the event that fuels, oils, concrete washout silts or other material harmful to plants have been spilled into the subgrade material, excavate the soil sufficiently to remove the harmful material. Fill any over excavation with approved fill and compact to the required subgrade compaction.
E. Remove stones larger than 1-1/2" in any dimension and sticks, roots, rubbish and other extraneous matter and legally dispose of them off the property.
F. Confirm that the subgrade is at the proper elevation and prepared as required. Subgrade elevations shall slope parallel to the finished grade and or toward the subsurface drain lines as shown on the drawings. Subsurface drains lines, if applicable, shall be installed prior to the installation of the Planting Soil.

1. Install grade stakes on a 20-foot grid in open areas and sufficiently spaced in other areas to insure correct line and grade of subgrade and finished grade. Verify subgrade elevations and do whatever additional grading is necessary to bring the subgrade to a true, smooth slope parallel to the finish grade.

G. Do not proceed with the installation of the Planting Soil until all proposed construction in the area has been installed. For site elements dependent on Planting Soil for foundation support, postpone installation until immediately after the installation of Planting Soil. Excavate area adjacent to walks and structures with care so not to undermine the supporting structure.

H. For on-grade applications:

1. Once rough grading of subgrade has been completed, the subgrade shall be loosened and fine graded by harrowing, disking, dragging the teeth of a backhoe bucket through the subgrade, or as dictated by the condition of the subgrade to a depth of 6” minimally to mitigate compaction created during grading operations.
2. Loosen subgrade incrementally in bands to the extent which Planting Soil can be installed without traversing the area repeatedly with equipment. Each band shall be equal to the reach of the loader bucket. Work from the interior areas to outside edges to avoid driving over previously loosened subgrade.

I. Request subgrade review by Landscape Architect prior to placing Planting Soil. Clean up subgrade and dispose of all debris prior to review. Planting Soil installation should proceed immediately following subgrade preparation.

3.05 INSTALLATION OF PLANTING SOIL

A. Do not place, spread or grade Planting Soil when muddy or excessively wet or frozen. Only work soil when friable. Adhere to environmental requirements as specified herein.
B. Soil Transition Layer: To facilitate soil drainage and de-compaction and to decrease hardpan conditions, spread approximately 3-inches of Planting Soil over loosened subgrade. Till Planting Soil thoroughly into the top 5 to 6 inches of subgrade. Spread the remainder of Planting Soil.

1. Create the Soil Transition Layer incrementally in bands to the extent that Planting Soil can be installed without traversing the area repeatedly with equipment. Each band shall be equal to the reach of the loader bucket. Work from the interior areas to outside edges to avoid driving over previously loosened subgrade.

C. Placing, spreading and compacting of Planting Soil may be done using one the following methods.

1. Place Planting Soil in bands to full depth over approved subgrade as shown on the drawings. Each band shall be equal to the reach of the loader bucket. Work from the interior areas to outside edges to avoid driving over previously placed soil.
2. Place Planting Soil in 6-inch to 8-inch lifts to full depth indicated. Lightly compact each lift of Planting Soil to prevent settlement and to consolidate soil. Compaction shall be 80% standard Proctor density and shall not exceed 85% standard Proctor density as determined by ASTM D698-12. Approved compaction equipment includes a smooth drum roller or plate compactor. Typically one to three passes per lift will achieve approximately 80% to 85% standard Proctor density. Conditions will vary depending on exact soil properties. The Contractor shall adjust installation methods to achieve uniform compaction at the specified rate. Use of vibratory machines is prohibited, as they will create greater compaction levels than specified herein. Minimize driving over the same areas of previously installed lifts of Planting Soil to the greatest extent possible to avoid over-compaction. Back-drag areas that have become compacted with the teeth of the loader bucket before placing the next lift.

3. To confirm specified compaction levels are met, perform one (1) Proctor density test for the first lift of Planting Soil and subsequent Proctor test for every other lift performed in the first band to be installed. Once verification that compaction methodology conforms to the specified levels installation of the remaining soil installation can proceed. To ensure compaction consistency is being maintained over the course of the work for subsequent planting areas, perform one (1) Proctor density test for every 5,000 square feet of material installed. Proctor density test reports shall be provided to the Landscape Architect for verification. Planting Soil installed with compaction levels exceeding 85% standard Proctor shall be removed and reinstalled at the Contractors expense.

D. Final finished grade elevation should be greater than the depth required per the Drawings to allow for initial settlement. Taper additional soil volume as required to meet structures including, but not limited to, walls, paving, and curbs. Allow for settlement of 1/2 inch to 1 inch per of installed soil depth.
E. Grading Tolerances: Planting areas shall be fine graded within 1 inch of grades indicated on the Drawings. Tolerances shall be within 1/2-inch of grade when meeting with paved surfaces, curbs, walls, or other structures. Maintain all flat areas and slopes to allow free flow of surface drainage without ponding.

3.06 EROSION CONTROL MATERIALS

A. Areas with slopes greater than or equal to 6:1, shall be covered with secured erosion control blanket within two (2) days or prior to any precipitation, whichever is shorter in accordance with the product requirements specified herein.

1. Install erosion control blankets prior to installation of trees, shrubs, herbaceous plants and groundcovers. See Section ‘Plants’ for planting requirements.
2. Install erosion-control blanket and fasten per manufacturer’s instructions. Install from top of slope, working downward.

3.07 CLEAN UP

A. Maintain the site in an orderly condition during the progress of work. Promptly remove debris and trash. Leave the site in a neat, orderly condition, broom clean.

END OF SECTION 329100

SECTION 32 92 00 - TURF AND GRASSES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Seeding of new lawns.
2. Reseeding of lawns damaged during construction.
3. Maintenance of lawn areas until acceptance.

1.02 RELATED SECTIONS

A. Section 329100 – Planting Preparation
B. Section 329300 - Plants

1.03 SUBMITTALS

A. Submit prior to delivery of materials to site.

1. Submit seed mixes for review.

B. Certifications: Submit certificate with names of materials and manufacturer.

1. Ground limestone: Include guaranteed analysis, and weight for packaged material.
2. Commercial fertilizers: Include guaranteed analysis.
3. Seed: include origin of seed.

C. Product data: Submit product literature or tear sheets with name of product, and manufacturer.

1. Commercial fertilizer, including type and application rate.

D. Source of supply: Submit in writing all proposed sources.
E. Test reports: Submit test reports at least three (3) weeks prior to delivery of materials to site.

1. Seed: Test for purity, proportion by weight, weed seed content and germination percentage of all seed mixture proposed for use. No seed shall be delivered until the test reports are approved. All seed shall be tested within six (6) months immediately preceding date of sowing.

1.04 QUALITY ASSURANCE

A. Contractor shall have had experience with at least two (2) other projects of similar scope and complexity and shall perform work with personnel totally familiar with lawn installation, seeding operations and general construction techniques under the supervision of an experienced landscape foreperson.
B. Seed producer: manufacturer specializing in grass seed production with a minimum of 5 years experience and certified by the New Jersey Department of Agriculture.
C. Seed must comply with all State of New Jersey seed certifications.

1.05 DELIVERY STORAGE AND HANDLING

A. Packaged materials: Deliver packaged materials in clearly marked containers showing net weight, guaranteed analysis and name of manufacturer. Specified requirements for

packaged materials apply to bulk shipments. Protect materials from deterioration during delivery and during storage at site.

1. Deliver fertilizer and limestone in waterproof bags.
2. All seed shall be labeled to show compliance with requirements of governmental agencies having jurisdiction. All bag tags of seed used shall be retained and if requested, submitted to Owner. Seed shall be kept in dry storage away from contaminants, insects and rodents.

1.06 PROJECT CONDITIONS

A. Protection of existing conditions adjacent to and within construction zone:

1. All necessary precautions for safety including barricades and other protection measures shall be taken during all work.
2. All heavy equipment shall be driven or parked on the site only where approved by Owner.
3. Existing pavements, lawns, structures, walls, etc. damaged or disturbed during construction shall be repaired or replaced to the satisfaction of the Owner.
4. Repair and replace all active utility lines, above and below grade, damaged in the course of construction operations.
5. Avoid damaging existing trees. Damage includes but is not limited to: cutting, breaking, skinning or compacting of roots, skinning and bruising of bark and breaking of branches and limbs.
   a. Contractor shall not park or store equipment and supplies within four (4) feet of trunk of existing trees to remain.

B. Environmental requirements:

1. Seed only between April 1 - May 15 and September 1 - October 15, unless otherwise permitted by the Owner.
2. Do not seed during adverse weather, windy conditions or on wet or frozen ground.

PART 2 - PRODUCTS

2.01 SEED

A. Fresh, clean, new seed. Seed shall be packed in sealed 50 lb. bags showing net weight, composition of mix, date of germination tests and supplier's name. Germination test must be done within a nine-month period prior to sale of the seed.

1. Seed shall not contain in excess of 0.1% by weight weed seed, no more than 1.5% inert matter, and no more than 0.1% other crop seed and no noxious weed seed or undesirable grass species. Comply with state laws governing noxious weeds. Seed containing prohibited or restricted noxious weeds shall not be accepted.
2. Seed shall be provided by a seed wholesaler registered with New Jersey Department of Agriculture.

B. Composition of the mix shall be a turf-type tall fescue blend of at least three (3) varieties of turf-type tall fescue and no more than 10% Kentucky Bluegrass.

2.02 LIMESTONE

A. In accordance with soil test recommendations, provide ground, high magnesium limestone containing not less than 85% total carbonates, 95% passing a 20 mesh sieve, 40% passing a 60 mesh sieve and a minimum of 30% percent passing a 100 mesh sieve.

2.03 MULCH

A. Mulch shall consist of specially prepared wood cellulose processed into a uniform fibrous physical state. Wood cellulose fiber mulch shall be dyed green or contain a green dye in the package that will provide an appropriate color to facilitate visual inspection of the uniformly spread slurry. The fiber mulch, including dye, shall contain no germination or growth inhibiting factors. The mulch material shall be manufactured and processed in such a manner that the wood cellulose fiber mulch will remain in uniform suspension in water under agitation and will blend with other additives to form a homogenous slurry. The mulch material shall form a blotter-like ground cover, on application, having moisture absorption and percolation properties and shall cover and hold grass seed in contact with the soil without inhibiting the growth of the grass seedlings.
B. Mulch shall contain no elements or compounds at concentration levels that will be phytotoxic. Wood cellulose fiber must conform to the following physical requirements:

1. fiber length to be approximately 10 mm
2. diameter approximately 1 mm
3. pH range of 4.0 to 8.5
4. ash content of 1.6% maximum
5. water holding capacity of 90% minimum

C. Slope stabilization: in areas where erosion may occur, use an organic tackifier such as CON-TACK or an erosion fabric or approved equal, in accordance with manufacturer's instructions.

2.04 WATER

A. Potable, clean fresh and free from harmful materials. Contractor shall provide all means of conveyance including hoses, sprinklers, tank trucks or other means which may be required to water lawns until accepted by Owner.

2.05 FERTILIZER

A. A standard complete slow release fertilizer. At least 50% by weight of the nitrogen content of the fertilizer shall be derived from organic materials with the remainder in urea form or equivalent. Fertilizer shall contain percent nitrogen, phosphorous, and potash by weight of ingredients dictated by the topsoil test results.

1. Fertilizer shall be in bags showing weight, analysis, and manufacturer's name

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin lawn work until all other work is complete. Commencement of work means acceptance of existing conditions.

3.02 INSTALLATION

A. Grass seed shall be applied to all disturbed areas a result of this project.
B. Preparation of surface for seeded areas (except within root zones of existing trees):

1. Vertically aerate soil if it has become compacted as a result of construction activities.
2. Prior to applying soil amenities, roll lawn area with a filled water roller. Correct any surface irregularities to prevent formation of low spots.

3. If required by soil test, evenly distribute ground limestone at the recommended rate. Work lightly into the top four (4) inches of topsoil at least one full week prior to applying fertilizer.
4. Spread starter fertilizer uniformly, at the rate determined by soil test for new lawns. Add organic matter 1" deep, if required by soil test.
5. Go over the entire area with a spike drag or rototiller and loosen surface at least 3" deep and then hand rake to a smooth, even surface.

C. Seeding

1. As soon as ground has been properly prepared, sow grass seed at the rate of 6 lbs. per 1,000 sq. ft. total. Distribute seed evenly over entire area by sowing equal quantity in two directions at right angles to each other.
    a. Use suitable mechanical seeder to sow by hand for small areas.
2. Cover seed with a thin layer of topsoil by light raking.
3. Roll seed in both directions very lightly with an empty water roller.
4. After seed application, apply mulch at a net dry weight of 1,500 lbs. per acre. Mulch shall be mixed with water and the mixture shall contain a maximum of 50 lbs. of wood cellulose fiber per 100 gallons of water. Use a slope stabilizing device in areas where erosion may occur.
5. Water with a fine spray immediately after seeding operations are completed.
    a. Water all newly installed seeded areas as necessary to keep lawn healthy. Apply water in sufficient quantities so it penetrates four (4) inches into planting soil without puddling. Continue watering until seeded areas are accepted by the Owner.
6. Protect all newly seeded lawn areas from damage.
7. When seeding occurs after acceptable seeding dates, over winter protection shall consist of applying five bales clean straw per 1,000 sq. ft. and anchor mulch by commercial mulch netting or 20 lbs./1,000 sq. ft. cellulose fiber. Asphalt emulsion anchoring is not permitted.

3.03 MAINTENANCE

A. Begin maintenance immediately after each lawn area is restored.

1. All lawn areas shall be watered and kept moist to maximize germination.
    a. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch.
    b. Seed: Water seeded areas as often as required to keep the top 1-inch of soil moist until the seed germinates. Avoid excessive water that will cause the seeds to rot. Once seedlings have germinated and established reduce watering frequency and increase volume for deeper watering. Continually adjust irrigation system until intervals have been stretched to the greatest extent practical.
2. All areas and spots which do not show a prompt catch of grass shall be reseeded and this operation repeated until complete coverage is obtained.
3. When the area does not need to be reseeded, it shall be thoroughly wetted every time the surface shows evidence of drying out and this shall continue through entire period of maintenance.
4. When the average height is 3-4" and the lawn areas are fully germinated, firmly rooted and secure in place, grass shall be cut to 2-3" or 1/3 of the grass blade. Any depressions or irregularities in the lawn surface shall be leveled off and reseeded.

5. Maintenance shall cease after the third mowing, provided all grass areas are properly established and free of washouts, depressions, bare spots, weeds and large off-color areas. If seeding is done in the autumn, the Contractor shall complete the three mowings in the following spring.
6. All lawns shall show a uniform, thick, well-developed stand of grass. If the grass stand is unsatisfactory, the Contractor's maintenance responsibility shall continue until an acceptable stand of grass is achieved.

3.04 FINAL INSPECTION AND ACCEPTANCE

A. At the end of the maintenance period, inspection will be made by the Owner and the Contractor. Any lawn area under this Contract that is not in satisfactory condition, as determined by the Owner, shall be reworked as soon as conditions permit. All reworked lawn areas shall be maintained as specified.

3.05 CLEAN UP

A. Maintain the site in an orderly condition during the progress of work. Promptly remove debris and trash. Leave the site in a neat, orderly condition, broom clean.

END OF SECTION 329200