CITY OF ANN ARBOR
INVITATION TO BID

Water Treatment Plant
2018 Architectural and Structural Repairs

ITB No. 4553

Due Date: December 13, 2018 at 2:00PM (Local Time)

Public Services Area/Water Treatment Services Unit
Administering Service Area/Unit

Issued By:

City of Ann Arbor
Procurement Unit
301 E. Huron Street
Ann Arbor, MI 48104

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NOTICE OF PRE-BID CONFERENCE

A pre-bid conference for this project will be held at the Water Treatment Plant on **Tuesday, November 27, 2018, at 10:00 AM** at **919 Sunset Road, Ann Arbor, MI 48103**.

The meeting with be followed by site visits to two of the five outstations identified in the scope of work: Barton Pump Station and Superior Hydroelectric building. These facilities require keyed entry and accompaniment by City staff. Addresses for these sites are below:

Barton Pump Station – 1010 Huron River Drive, Ann Arbor, MI 48103
Superior Hydroelectric – 6000 First Street, Superior Township, MI 48198

Attendance at this conference is highly recommended. Administrative and technical questions regarding this project will be answered at this time. The pre-bid conference is for information only. Any answers furnished will not be official until verified in writing by the Financial Service Area, Procurement Unit. Answers that change or substantially clarify the bid will be affirmed in an addendum.

The other three outstations will not be part of the pre-bid conference site visit, but may be visited as desired by visiting the following locations:

North Campus Pump Station – 1800 Beal Ave., Ann Arbor, MI 48105
South Industrial Pump Station – 2000 S. Industrial Hwy, Ann Arbor, MI 48104
Liberty Pump Station – 2675 Liberty St., Ann Arbor, MI 48103

Please note that only exterior elevations of these three outstations will be accessible for the prospective bidder's inspection. If access to the rooftop or the interior is desired, please contact the Owner to make arrangements.

If desired, there will be additional opportunities to inspect the WTP site on the days listed below, between the hours of 9:00am and 3:30pm. The site visits will not be a repeat of the pre-bid meeting. Please contact Emily Schlanderer at ESchlanderer@a2gov.org to make arrangements prior to coming.

Thursday, November 29, 2018
Tuesday, December 4, 2018
Thursday, December 6, 2018

Roofing Evaluation and Building Envelope (Masonry) Evaluation Reports of the WTP buildings and five (5) outstations, completed in 2017, can be made available for viewing at the Water Treatment Plant before or after the Pre-Bid Conference, or by appointment. Photos reports of the WTP, Barton PS, Superior Hydroelectric and other three outstations are included in Appendix A.

INSTRUCTIONS TO BIDDERS

General

Work to be done under this Contract is generally described through the detailed specifications and must be completed fully in accordance with the contract documents. All work to be done under this Contract is located in or near the City of Ann Arbor.

Any Bid which does not conform fully to these instructions may be rejected.

Preparation of Bids

Bids should be prepared providing a straight-forward, concise description of the Bidder's ability to meet the requirements of the ITB. Bids shall be written in ink or typewritten. No erasures are permitted. Mistakes may be crossed out and corrected and must be initialed and dated in ink by the person signing the Bid.

Bids must be submitted on the "Bid Forms" provided with each blank properly filled in. If forms are not fully completed it may disqualify the bid. No alternative bid will be considered unless alternative bids are specifically requested. If alternatives are requested, any deviation from the specification must be fully described, in detail on the "Alternate" section of Bid form.

Each person signing the Bid certifies that he/she is the person in the Bidder's firm/organization responsible for the decision as to the fees being offered in the Bid and has not and will not participated in any action contrary to the terms of this provision.

Questions or Clarifications / Designated City Contacts

All questions regarding this ITB shall be submitted via email. Emailed questions and inquires will be accepted from any and all prospective Bidders in accordance with the terms and conditions of the ITB.

All questions shall be due on or before **Tuesday, December 4 at 5:00 PM (local time)** and should be addressed as follows:

> Specification/Scope of Work questions emailed to **ESchlanderer@a2gov.org**
> Bid Process and Compliance questions emailed to cspencer@a2gov.org

Any error, omissions or discrepancies in the specification discovered by a prospective contractor and/or service provider shall be brought to the attention of Colin Spencer at **CSpencer@a2gov.org** after discovery as possible. Further, the contractor and/or service provide shall not be allowed to take advantage of errors, omissions or discrepancies in the specifications.

Addenda

If it becomes necessary to revise any part of the ITB, notice of the Addendum will be posted to Michigan Inter-governmental Trade Network (MITN) www.mitn.info and/or City of Ann Arbor web site www.A2gov.org for all parties to download.

Each Bidder must in its Bid, to avoid any miscommunications, acknowledge all addenda which it has received, but the failure of a Bidder to receive, or acknowledge receipt of; any addenda shall not relieve the Bidder of the responsibility for complying with the terms thereof.

The City will not be bound by oral responses to inquiries or written responses other than written addenda.

Bid Submission

All Bids are due and must be delivered to the City of Ann Arbor Procurement Unit on or before **Thursday, December 13, 2018 at 2:00 PM EST.** Bids submitted late or via oral, telephonic, telegraphic, electronic mail or facsimile **will not** be considered or accepted.

Each Bidder must submit one (1) original Bid and five **(5)** Bid copies in a sealed envelope clearly marked: **ITB No. 4553 – Water Treatment Plant 2018 Architectural and Structural Repairs.**

Bids must be addressed and delivered to:

City of Ann Arbor
Procurement Unit,
c/o Customer Services, 1st Floor
301 East Huron Street
Ann Arbor, MI 48107

All Bids received on or before the Due Date will be publicly opened and recorded immediately. No immediate decisions are rendered.

The following forms provided within this ITB Document must be included in submitted bids.

- **City of Ann Arbor Prevailing Wage Declaration of Compliance**
- **City of Ann Arbor Living Wage Ordinance Declaration of Compliance**
- **Vendor Conflict of Interest Disclosure Form**
- **City of Ann Arbor Non-Discrimination Ordinance Declaration of Compliance**

Bids that fail to provide these completed forms listed above upon bid opening will be rejected as non-responsive and will not be considered for award.

Hand delivered bids will be date/time stamped/signed by the Procurement Unit at the address above in order to be considered. Normal business hours are 9:00 a.m. to 3:00 p.m. Monday through Friday, excluding Holidays. The City will not be liable to any Bidder for any unforeseen circumstances, delivery or postal delays. Postmarking to the Due Date will not substitute for receipt of the Bid. Each Bidder is responsible for submission of their Bid.

Additional time for submission of bids past the stated due date and time will not be granted to a single Bidder; however, additional time may be granted to all Bidders when the City determines in its sole discretion that circumstances warrant it.

Award

The City intends to award a Contract(s) to the lowest responsible Bidder(s). On multi-divisional contracts, separate divisions may be awarded to separate Bidders. The City may also utilize alternatives offered in the Bid Forms, if any, to determine the lowest responsible Bidder on each division, and award multiple divisions to a single Bidder, so that the lowest total cost is achieved for the City. For unit price bids, the Contract will be awarded based upon the unit prices and the lump sum prices stated by the bidder for the work items specified in the bid documents, with consideration given to any alternates selected by the City. If the City determines that the unit price for any item is materially different for the work item bid than either other bidders or the general market, the City, in its sole discretion, in addition to any other right it may have, may reject the bid

as not responsible or non-conforming.

The acceptability of major subcontractors will be considered in determining if a Bidder is responsible. In comparing Bids, the City will give consideration to alternate Bids for items listed in the bid forms. All key staff and subcontractors are subject to the approval by the City.

Qualifications

The City will evaluate Bids based on cost as well as experience. Contractors that have not included the required list of similar work experience, resumes for project manager and superintendent, and associated references in Section 5 of the Bid Form may have their bid rejected.

As part of the bid, Bidders shall provide documentation that the Bidder's company and/or subcontractors have at least 10 years of experience providing construction of roofing replacement and masonry repairs. Bidders shall also submit, for the proposed Project Manager and Superintendent, resumes documenting 7 years of professional experience for each individual in the construction industry as a full-time employee, along with 3 references for each individual from previous projects completed within the past 7 years. Bidders shall also submit the attached form, "Section 5 – References," which identifies a minimum of 3 projects completed in the past 7 years at similar facilities, including construction cost, contractor and subcontractor information, that demonstrate similar work experience and complexity to that included within these contract documents, specifically roofing replacement, masonry repairs, and interior finishes.

All key staff and subcontractors are subject to approval by the City.

Official Documents

The City of Ann Arbor officially distributes bid documents from the Procurement Unit or through the Michigan Intergovernmental Trade Network (MITN). Copies of the bid documents obtained from any other source are not Official copies. Addenda and other bid information will only be posted to these official distribution sites. If you obtained City of Ann Arbor Bid documents from other sources, it is recommended that you register on www.MITN.info and obtain an official Bid. Bidders do not need to be shown on the plan holders list provided by MITN to be considered an official plan holder.

Bid Security

Each bid must be accompanied by a certified check, or Bid Bond by a surety licensed and authorized to do business within the State of Michigan, in the amount of 5% of the total of the bid price.

Withdrawal of Bids

After the time of opening, no Bid may be withdrawn for the period of one hundred twenty (120) days.

Contract Time

Time is of the essence in the performance of the work under this Contract. The available time for work under this Contract is indicated on page C-1, Article III of the Contract. If these time requirements can not be met, the Bidder must stipulate on Bid Form Section 3 - Time Alternate its schedule for performance of the work. Consideration will be given to time in evaluating bids.

Liquidated Damages

A liquidated damages clause, as given on page C-2, Article III of the Contract, provides that the Contractor shall pay the City as liquidated damages, and not as a penalty, a sum certain per day for each and every day that the Contractor may be in default of completion of the specified work, within the time(s) stated in the Contract, or written extensions.

Liquidated damages clauses, as given in the General Conditions, provide further that the City shall be entitled to impose and recover liquidated damages for breach of the obligations under Chapter 112 of the City Code.

The liquidated damages are for the non-quantifiable aspects of any of the previously identified events and do not cover actual damages that can be shown or quantified nor are they intended to preclude recovery of actual damages in addition to the recovery of liquidated damages.

Human Rights Information

All contractors proposing to do business with the City shall satisfy the contract compliance administrative policy adopted by the City Administrator in accordance with the Section 9:158 of the Ann Arbor City Code. Breach of the obligation not to discriminate as outlined in Section 5, beginning at page GC-2 shall be a material breach of the contract. Contractors are required to post a copy of Ann Arbor's Non-Discrimination Ordinance attached at all work locations where its employees provide services under a contract with the City.

Wage Requirements

Section 4, beginning at page GC-1, outlines the requirements for payment of prevailing wages and for payment of a "living wage" to employees providing service to the City under this contract. The successful bidder and its subcontractors must comply with all applicable requirements and provide proof of compliance.

Pursuant to Resolution R-16-469 all public improvement contractors are subject to prevailing wage and will be required to provide to the City payroll records sufficient to demonstrate compliance with the prevailing wage requirements. Use of the Prevailing Wage Form provided in the Appendix section or a City-approved equivalent will be required along with wage rate interviews.

For laborers whose wage level are subject to federal, state and/or local prevailing wage law the appropriate Davis-Bacon wage rate classification is identified based upon the work including within this contract. **The wage determination(s) current on the date 10 days before bids are due shall apply to this contract.** The U.S. Department of Labor (DOL) has provided explanations to assist with classification in the following resource link: www.wdol.gov.

For the purposes of this ITB the Construction Type of __Building__ will apply.

Conflict Of Interest Disclosure

The City of Ann Arbor Purchasing Policy requires that prospective Vendors complete a Conflict of Interest Disclosure form. A contract may not be awarded to the selected Vendor unless and until the Procurement Unit and the City Administrator have reviewed the Disclosure form and determined that no conflict exists under applicable federal, state, or local law or administrative regulation. Not every relationship or situation disclosed on the Disclosure Form may be a disqualifying conflict. Depending on applicable law and regulations, some contracts may awarded on the recommendation of the City Administrator after full disclosure, where such action is allowed

by law, if demonstrated competitive pricing exists and/or it is determined the award is in the best interest of the City. A copy of the Vendor Conflict of Interest Disclosure Form is attached.

Major Subcontractors

The Bidder shall identify on Bid Form Section 4 each major subcontractor it expects to engage for this Contract if the work to be subcontracted is 15% or more of the bid sum or over $50,000, whichever is less. The Bidder also shall identify the work to be subcontracted to each major subcontractor. The Bidder shall not change or replace a subcontractor without approval by the City.

Debarment

Submission of a Bid in response to this ITB is certification that the Bidder is not currently debarred, suspended, proposed for debarment, and declared ineligible or voluntarily excluded from participation in this transaction by any State or Federal departments or agency. Submission is also agreement that the City will be notified of any changes in this status.

Disclosures

After bids are opened, all information in a submitter's bid is subjected to disclosure under the provisions of Michigan Public Act No. 442 of 1976, as amended (MCL 15.231 et seq.) known as the "Freedom of Information Act." The Freedom of Information Act also provides for the complete disclosure of contracts and attachments thereto except where specifically exempted.

Bid Protest

All Bid protests must be in writing and filed with the Purchasing Agent within five (5) business days of the award action. The bidder must clearly state the reasons for the protest. If a bidder contacts a City Service Area/Unit and indicates a desire to protest an award, the Service Area/Unit shall refer the bidder to the Purchasing Agent. The Purchasing Agent will provide the bidder with the appropriate instructions for filing the protest. The protest shall be reviewed by the City Administrator or designee whose decision shall be final.

Any inquiries or requests regarding this procurement should be only submitted in writing to the Designated City Contacts provided herein. Attempts by any prospective bidder to initiate contact with anyone other than the Designated City Contacts provided herein that the bidder believes can influence the procurement decision, e.g., Elected Officials, City Administrator, Selection Committee Members, Appointed Committee Members, etc., may lead to immediate elimination from further consideration.

Cost Liability

The City of Ann Arbor assumes no responsibility or liability for costs incurred by the Bidder prior to the execution of a contract with the City. By submitting a bid, a bidder agrees to bear all costs incurred or related to the preparation, submission and selection process for the bid.

Reservation of Rights

The City of Ann Arbor reserves the right to accept any bid or alternative bid proposed in whole or in part, to reject any or all bids or alternatives bids in whole or in part and to waive irregularity and/or informalities in any bid and to make the award in any manner deemed in the best interest of the City.

Idlefree Ordinance

The City of Ann Arbor adopted an idling reduction Ordinance that goes into effect July 1, 2017. The full text of the ordinance (including exemptions) can be found at: www.a2gov.org/idlefree.

Under the ordinance, No Operator of a Commercial Vehicle shall cause or permit the Commercial Vehicle to Idle:

(a) For any period of time while the Commercial Vehicle is unoccupied; or

(b) For more than 5 minutes in any 60-minute period while the Commercial Vehicle is occupied.

In addition, generators and other internal combustion engines are covered

(1) Excluding Motor Vehicle engines, no internal combustion engine shall be operated except when it is providing power or electrical energy to equipment or a tool that is actively in use.

Environmental Commitment

The City of Ann Arbor recognizes its responsibility to minimize negative impacts on human health and the environment while supporting a vibrant community and economy. The City further recognizes that the products and services the City buys have inherent environmental and economic impacts and that the City should make procurement decisions that embody, promote, and encourage the City's commitment to the environment.

The City encourages potential vendors to bring forward emerging and progressive products and services that are best suited to the City's environmental principles.

SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

Bidders shall submit with their Bid, responses to the following. Responses shall be prepared to numerically match the itemized list as follows:

1. Bidder shall submit a formal/written safety program.

2. Bidder shall describe the job site safety program for this project and specific safety policies in which employees must be in compliance.

3. Bidder shall provide the organizations most current OSHA 300 logs or reasons why this organization is exempt from OSHA 300 reporting.

4. Bidder shall provide the organization's most recent OSHA recordable incident rate, DART rate, and lost workday rate.

5. If applicable, bidder shall provide the organization's excavation and trench safety program. Within this program, please identify the organization's Qualified Person for excavation and trench safety that will be on-site daily.

6. Bidder shall identify the project safety team, their qualifications, duties and city(s) of residence.

7. Bidder shall identify any major accidents or incidents that resulted in major injury or deaths that have occurred on a project site controlled by the firm, or any subcontractor(s) (at any contractual level), that had any major injury or death on a project site? If so, describe how the organization has revised the program.

INVITATION TO BID

City of Ann Arbor
Guy C. Larcom Municipal Building
Ann Arbor, Michigan 48107

Ladies and Gentlemen:

The undersigned, as Bidder, declares that this Bid is made in good faith, without fraud or collusion with any person or persons bidding on the same Contract; that this Bidder has carefully read and examined the bid documents, including City Nondiscrimination requirements and Declaration of Compliance Form, Living Wage requirements and Declaration of Compliance Form, Prevailing Wage requirements and Declaration of Compliance Form, Vendor Conflict of Interest Form, Notice of Pre-Bid Conference, Instructions to Bidders, Bid, Bid Forms, Contract, Bond Forms, General Conditions, Standard Specifications, Detailed Specifications, all Addenda, and the Plans (if applicable) and understands them. The Bidder declares that it conducted a full investigation at the site and of the work proposed and is fully informed as to the nature of the work and the conditions relating to the work's performance. The Bidder also declares that it has extensive experience in successfully completing projects similar to this one.

The Bidder acknowledges that it has not received or relied upon any representations or warrants of any nature whatsoever from the City of Ann Arbor, its agents or employees, and that this Bid is based solely upon the Bidder's own independent business judgment.

The undersigned proposes to perform all work shown on the plans or described in the bid documents, including any addenda issued, and to furnish all necessary machinery, tools, apparatus, and other means of construction to do all the work, furnish all the materials, and complete the work in strict accordance with all terms of the Contract of which this Bid is one part.

In accordance with these bid documents, and Addenda numbered _____, the undersigned, as Bidder, proposes to perform at the sites in and/or around Ann Arbor, Michigan, all the work included herein for the amounts set forth in the Bid Forms.

The Bidder declares that it has become fully familiar with the liquidated damage clauses for completion times and for compliance with City Code Chapter 112, understands and agrees that the liquidated damages are for the non-quantifiable aspects of non-compliance and do not cover actual damages that may be shown and agrees that if awarded the Contract, all liquidated damage clauses form part of the Contract.

The Bidder declares that it has become fully familiar with the provisions of Chapter 14, Section 1:320 (Prevailing wages) and Chapter 23 (Living Wage) of the Code of the City of Ann Arbor and that it understands and agrees to comply, to the extent applicable to employees providing services to the City under this Contract, with the wage and reporting requirements stated in the City Code provisions cited. Bidder certifies that the statements contained in the City Prevailing Wage and Living Wage Declaration of Compliance Forms are true and correct. Bidder further agrees that the cited provisions of Chapter 14 and Chapter 23 form a part of this Contract.

The Bidder declares that it has become familiar with the City Conflict of Interest Disclosure Form and certifies that the statement contained therein is true and correct.

The Bidder encloses a certified check or Bid Bond in the amount of 5% of the total of the Bid Price. The Bidder agrees both to contract for the work and to furnish the necessary Bonds and insurance documentation within 10 days after being notified of the acceptance of the Bid.

If this Bid is accepted by the City and the Bidder fails to contract and furnish the required Bonds and insurance documentation within 10 days after being notified of the acceptance of this Bid, then the Bidder shall be considered to have abandoned the Contract and the certified check or Bid Bond accompanying this Bid shall become due and payable to the City.

If the Bidder enters into the Contract in accordance with this Bid, or if this Bid is rejected, then the accompanying check or Bid Bond shall be returned to the Bidder.

In submitting this Bid, it is understood that the right is reserved by the City to accept any Bid, to reject any or all Bids, to waive irregularities and/or informalities in any Bid, and to make the award in any manner the City believes to be in its best interest.

SIGNED THIS _____ DAY OF _____, 201_.

_____	_____
Bidder's Name	Authorized Signature of Bidder
_____	_____
Official Address	(Print Name of Signer Above)
_____	_____
Telephone Number	Email Address for Award Notice

LEGAL STATUS OF BIDDER

(The Bidder shall fill out the appropriate form and strike out the other three.)

Bidder declares that it is:

* A corporation organized and doing business under the laws of the State of _____, for whom _____, bearing the office title of _____, whose signature is affixed to this Bid, is authorized to execute contracts.

NOTE: If not incorporated in Michigan, please attach the corporation's Certificate of Authority

• A limited liability company doing business under the laws of the State of _____, whom _____ bearing the title of _____ whose signature is affixed to this proposal, is authorized to execute contract on behalf of the LLC.

* A partnership, organized under the laws of the state of _____ and filed in the county of _____, whose members are (list all members and the street and mailing address of each) (attach separate sheet if necessary):

_____

_____

_____

_____

_____

* An individual, whose signature with address, is affixed to this Bid: __ _____
(initial here)

Authorized Official

_____ **Date** _____**,** 201_

(Print) Name _____ Title _____

Company: _____

Address: _____

Contact Phone ( ) _____ Fax ( ) _____

Email _____

BID FORM

Section 1 – Schedule of Prices

Company: _____

Project: **Water Treatment Plant 2018 Architectural and Structural Repairs**
ITB No. 4553

Bid Items –

Notes:

1. All nine (9) Base Bid sections shall be bid. Bidders shall provide a Unit Price for ALL bid items for each Base Bid section and Total Price for ALL Base Bid sections specified.
2. Bidder shall provide prices for all Alternate Bid items specified.
3. Quantities included in the bid tables represent estimated quantities for different work. The Contractor shall be compensated for the actual number of items completed using the unit prices provided.
4. Each item shall include all preparatory and post repair work, including but not limited to field measurements, shop drawings, scaffolding, demolition, dust control, protection of Owner equipment, protection of process water, clean up, restoration, and all related items.
5. The City, at its sole discretion, may elect to delete any portion of the work delineated below, with no change to the unit prices provided. Work shall be determined based upon the availability of funds.
6. Any item not provided in the following list shall be considered incidental.
7. Contract shall be awarded based on the base bid or any combination of a base bid(s) and alternate bid(s) in any manner the City believed to be in its best interest.

Base Bids

For the entire work outlined in these documents for Water Treatment Plant 2018 Architectural and Structural Repairs, complete as specified, using equipment and materials only of the type and manufacturers where specifically named.

A. Lump Sum Amount for Base Bid #1 for WATER TREATEMENT PLANT – CORE BUILDINGS (TOWER, PENTHOUSE, FILTER GALLERY, CARBON HOUSE, CONTROL ROOM, AND RAPID MIX)

BASE BID #1 – Water Treatment Plant – Core Buildings (Tower, Penthouse, Filter Gallery, Carbon House, Control Room, and Rapid Mix)					
LOCATION: 919 Sunset Road, Ann Arbor, MI 48103					
	Description	Units	Quantity	Unit Cost	Extended Cost
1.0	GENERAL				
1.1	General Conditions (Max 10%)	LS	1		$
1.2	Mobilization (Max 10%)	LS	1		$
1.3	Masonry Restoration Allowance	LS	1		$ 35,000
1.4	Permit Allowance	LS	1		$ 5,000
1.5	Certified Payroll Compliance and Reporting	LS	1		$
2.0	SITE PREPARATION / DEMOLITION	NOT	USED		
2.1	Hazardous Material Remediation Allowance for Bid Items 4.8,4.9, 7.1, 7.1.1, 8.1	LS	1		$45,000

3.0	CONCRETE				
3.1	Provide concrete patching at delaminated areas of concrete/precast walls as indicated on drawings by Repair Note R12 (Allowable Quantity)	SF	44	$	$
3.2	Provide crack injection repair at cracks in concrete/precast walls as indicated on drawings by Repair Note R13 (Allowable Quantity)	LF	35	$	$
4.0	MASONRY				
4.1	Re-point all mortar joints at areas indicated on drawings by Repair Note R1 and R2	SF	6,060	$	$
4.1.1	Re-point all cracked/weathered mortar joints at areas indicated on drawings by Repair Note R1.1 and R2.1 (Allowable Quantity)	SF	2200	$	$
4.2	Brick Rebuild/Replacement (Allowable Quantity for areas indicated on drawings by Repair Note R1 and R2)	SF	1700	$	$
4.2.1	Brick Rebuild/Replacement (Allowable Quantity for areas indicated on drawings by Repair Note R1.1 and R2.1)	SF	2250	$	$
4.3	Re-build masonry parapet wall as indicated on drawings by Repair Note R3.	LF	93	$	$
4.4	Provide limestone coping repair as indicated on drawings by Repair Note R4.	LF	130	$	$
4.5	Provide limestone coping repair as indicated on drawings by Repair Note R5.	LF	325	$	$
4.6	Provide steel lintel restoration as indicated on drawings by Repair Note R6.	LF	321	$	$
4.7	Re-build masonry building and corner as indicated on drawings by Repair Note R7.	LF	102	$	$
4.8	Provide new sealant and backer rod at expansion/control joints as indicated on drawings by Repair Note R8 (Allowable Quantity)	LF	173	$	$
4.9	Rout and seal cracks in masonry/concrete walls as indicated on drawings by Repair Note R9 (Allowable Quantity)	LF	122	$	$
4.10	Provide small patch or dutchman repair in limestone as indicated on drawings by Repair Note R14 (Allowable Quantity)	SF	12	$	$
4.11	Clean exterior masonry wall surfaces as indicated on drawing by Repair Note R18.	SF	13,510	$	$
4.12	Remove section of masonry parapet wall to underside of roof deck as indicated on Drawing E-4c; provide interior finish work as necessary.	LS	1	$	$
5.0	STRUCTURAL METALS	NOT	USED		
6.0	CARPENTRY	NOT	USED		
7.0	FLASHING AND MOISTURE PROTECTION				
7.1	“Wet seal” existing glass to frame window joints as indicated on drawings by Repair Note R10.	LF	3,236	$	$
7.1.1	Provide new sealant at window/door perimeter joints as indicated on drawings by Repair Note R11.	LF	2,435	$	$
7.3	Roofing Replacement at Tower - Roof Area P-1, including Asbestos Remediation in accordance with Specification Section 02 82 00	LS	1	$	$

7.4	Roofing Replacement at Penthouse – Roof Areas P-2, P-3, P-4 & P-6, including Asbestos Remediation in accordance with Specification Section 02 82 00	LS	1	$	$
7.5	Roofing Replacement at Rapid Mix Building – Roof Area R-1	LS	1	$	$
7.6	Roofing Replacement at Filter Gallery – Roof Areas F-2 & F-3	LS	1	$	$
7.7	Roofing Replacement at Filter Gallery – Roof Areas F-1, F-4, F-5, F-6 & F-7	LS	1	$	$
7.8	Roofing Replacement at Control Room Building – Roof Area CR-1 and CR-2	LS	1	$	$
7.9	Wet Insulation Replacement at Admin Building – Roof Area AD-1 (150sf)	LS	1	$	$
8.0	DOORS AND WINDOWS				
8.1	Revise existing openings, provide new aluminum frame windows and sill flashings as indicated on drawings by Repair Note R15.	SF	330	$	$
9.0	FINISHES				
9.1	Apply Elastomeric Coating at concrete wall surfaces as indicated on drawings by Repair Note R16.	SF	1,656	$	$
9.2	Provide clear, water repellent sealer at exterior masonry surfaces as indicated on drawings by Repair Note R17.	SF	518	$	$
BASE BID #1 TOTAL				$	

B. Lump Sum Amount for Base Bid #2 for WATER TREATMENT PLANT – INTERIOR RENOVATION PROJECT

BASE BID #2 – Water Treatment Plant – Interior Renovation Project					
LOCATION: 919 Sunset Road, Ann Arbor, MI 48103					
	Description	Units	Quantity	Unit Cost	Extended Cost
1.0	GENERAL				
1.1	General Conditions (Max 10%)	LS	1		$
1.2	Mobilization (Max 10%)	LS	1		$
1.3	Interior Renovation Allowance	LS	1		$ 15,000
1.4	Permit Allowance	LS	1		$ 5,000
1.5	Furniture Allowance (reception area, clerk area cubicle system and engineer's office)	LS	1		$ 25,000
1.6	Appliance Allowance (refrigerator, microwave and television monitors)	LS	1		$ 10,000
1.7	Certified Payroll Compliance and Reporting	LS	1		$
2.0	INTERIOR RENOVATION	NOT	USED		
2.1	Ground Floor: Corridor 016, and Stair 018; First Floor Walls: Corridors 110, 113, 119, 124, 126, and 127	LS	1	$	$
2.2	Ground Floor: Offices 004-010, and Clerks 003B.	LS	1	$	$
2.3	Ground Floor: Entry 101, Waiting 003A, Copy Room 011, Conference 012, Kitchenette 013, and Toilet 014.	LS	1	$	$
BASE BID #2 TOTAL				$	

C. Lump Sum Amount for Base Bid #3 for WATER TREATMENT PLANT – EAST ADDITIONS (ADMIN BUILDING, CALCINER BUILDING, FILTER PRESS BUILDING AND WHS BUILDING)

BASE BID #3 – Water Treatment Plant – East Additions (Admin Building, Calciner Building, Filter Press Building and WHS Building)

LOCATION: 919 Sunset Road, Ann Arbor, MI 48103

	Description	Units	Quantity	Unit Cost	Extended Cost
1.0	GENERAL				
1.1	General Conditions (Max 10%)	LS	1		$
1.2	Mobilization (Max 10%)	LS	1		$
1.3	Masonry Restoration Allowance	LS	1		$ 20,000
1.4	Certified Payroll Compliance and Reporting	LS	1		$
2.0	SITE PREPARATION / DEMOLITION	NOT	USED		
3.0	CONCRETE				
3.1	Provide concrete patching at delaminated areas of concrete/precast walls as indicated on drawings by Repair Note R12 (Allowable Quantity)	SF	40	$	$
3.2	Provide crack injection repair at cracks in concrete/precast walls as indicated on drawings by Repair Note R13 (Allowable Quantity)	LF	80	$	$
3.3	Remove and replace sealant at pre-cast panel joints as indicated on drawings by Repair Note R8.	LF	3,555	$	$
4.0	MASONRY				
4.1	Re-point all cracked/weathered mortar joints at areas indicated on drawings by Repair Note R1.1 (Allowable Quantity)	SF	220	$	$
4.1.1	Brick Rebuild/Replacement (Allowable Quantity for areas indicated on drawings by Repair Note R1.1)	SF	50	$	$
4.2	Provide steel lintel restoration as indicated on drawings by Repair Note R6.	LF	42	$	$
4.3	Provide new sealant and backer rod at expansion/control joints as indicated on drawings by Repair Note R8 (Allowable Quantity)	LF	2,911	$	$
4.4	Rout and seal cracks in masonry/concrete walls as indicated on drawings by Repair Note R9 (Allowable Quantity)	LF	50	$	$
4.5	Provide small patch or dutchman repair in limestone as indicated on drawings by Repair Note R14 (Allowable Quantity)	SF	50	$	$
5.0	STRUCTURAL METALS	NOT	USED		
6.0	CARPENTRY	NOT	USED		
7.0	FLASHING AND MOISTURE PROTECTION				
7.1	“Wet seal” existing glass to frame window joints as indicated on drawings by Repair Note R10.	LF	38	$	$
7.1.1	Provide new sealant at window/door perimeter joints as indicated on drawings by Repair Note R11.	LF	358	$	$
7.2	Roofing Replacement at Administration Building – Roof Areas AD-2 & AD-3	LS	1	$	$
7.3	Roofing Replacement at Calciner Building – Roof Area CA-2	LS	1	$	$

7.4	Wet Insulation Replacement at Admin Building – Roof Area AD-1 (160sf)	LS	1	$	$
8.0	DOORS AND WINDOWS	NOT	USED		
9.0	FINISHES				
9.1	"Scrape and paint" exposed steel as indicated on drawings by Repair Note R19.	SF	78	$	$
BASE BID #3 TOTAL				$	

D. Lump Sum Amount for Base Bid #4 for WATER TREATMENT PLANT – OUTBUILDINGS (AMMONIA BUILDING, EQ BUILDING, GENERATOR BUILDING, MAINTENANCE BUILDING, OZONE BUILDING AND RE-CARB BUILDING)

BASE BID #4 – Water Treatment Plant – Outbuildings (Ammonia Building, EQ Building, Generator Building, Maintenance Building, Ozone Building and Re-carb Building)					
LOCATION: 919 Sunset Road, Ann Arbor, MI 48103					
	Description	Units	Quantity	Unit Cost	Extended Cost
1.0	GENERAL				
1.1	General Conditions (Max 10%)	LS	1		$
1.2	Mobilization (Max 10%)	LS	1		$
1.3	Masonry Restoration Allowance	LS	1		$ 15,000
1.4	Certified Payroll Compliance and Reporting	LS	1		$
2.0	SITE PREPARATION / DEMOLITION	NOT	USED		
3.0	CONCRETE				
4.0	MASONRY				
4.1	Provide new sealant and backer rod at expansion/control joints as indicated on drawings by Repair Note R8 (Allowable Quantity)	LF	4,302	$	$
5.0	STRUCTURAL METALS	NOT	USED		
6.0	CARPENTRY	NOT	USED		
7.0	FLASHING AND MOISTURE PROTECTION				
7.1	Provide new sealant at window/door perimeter joints as indicated on drawings by Repair Note R11.	LF	875	$	$
7.2	Roofing Replacement at EQ Building – Roof Area EQ-1	LS	1	$	$
8.0	DOORS AND WINDOWS	NOT	USED		
9.0	FINISHES				
9.1	"Scrape and paint" exposed steel as indicated on drawings by Repair Note R19.	SF	64	$	$
BASE BID #4 TOTAL				$	

E. Lump Sum Amount for Base Bid #5 for BARTON PUMPING STATION

BASE BID #5 – Barton Pumping Station					
LOCATION: 1010 Huron River Drive, Ann Arbor, MI 48103					
	Description	Units	Quantity	Unit Cost	Extended Cost
1.0	GENERAL				
1.1	General Conditions (Max 10%)	LS	1		$
1.2	Mobilization (Max 10%)	LS	1		$
1.3	Masonry Restoration Allowance	LS	1		$ 8,000

1.4	Certified Payroll Compliance and Reporting	LS	1		$
2.0	SITE PREPARATION / DEMOLITION	NOT	USED		
3.0	CONCRETE				
4.0	MASONRY				
4.1	Re-point all cracked/weathered mortar joints at areas indicated on drawings by Repair Note R1.1 (Allowable Quantity)	SF	100	$	$
4.1.1	Brick Rebuild/Replacement (Allowable Quantity for areas indicated on drawings by Repair Note R1.1)	SF	20	$	$
5.0	STRUCTURAL METALS	NOT	USED		
6.0	CARPENTRY	NOT	USED		
7.0	FLASHING AND MOISTURE PROTECTION				
7.1	Roofing Replacement at Roof Area – BP-1, including Asbestos Remediation in accordance with Specification Section 02 82 00	LS	1	$	$
7.2	Roofing Replacement at Roof Area – BP-2, including Asbestos Remediation in accordance with Specification Section 02 82 00	LS	1	$	$
8.0	DOORS AND WINDOWS	NOT	USED		
9.0	FINISHES	NOT	USED		
BASE BID #5 TOTAL				$	

F. Lump Sum Amount for Base Bid #6 for SOUTH INDUSTRIAL PUMPING STATION

BASE BID #6 – South Industrial Pumping Station					
LOCATION: 2000 S. Industrial Highway, Ann Arbor, MI 48104					
	Description	Units	Quantity	Unit Cost	Extended Cost
1.0	GENERAL				
1.1	General Conditions (Max 10%)	LS	1		$
1.2	Mobilization (Max 10%)	LS	1		$
1.3	Masonry Restoration Allowance	LS	1		$ 12,500
1.4	Certified Payroll Compliance and Reporting	LS	1		$
2.0	SITE PREPARATION / DEMOLITION	NOT	USED		
3.0	CONCRETE	NOT	USED		
4.0	MASONRY				
4.1	Re-point all mortar joints at areas indicated on drawings by Repair Note R1	SF	1,341	$	$
4.1.1	Re-point all cracked/weathered mortar joints at areas indicated on drawings by Repair Note R1.1 (Allowable Quantity)	SF	30	$	$
4.2	Brick Rebuild/Replacement (Allowable Quantity for areas indicated on drawings by Repair Note R1)	SF	30	$	$
4.3	Provide steel lintel restoration as indicated on drawings by Repair Note R6.	LF	66	$	$
4.4	Provide new sealant and backer rod at expansion/control joints as indicated on drawings by Repair Note R8 (Allowable Quantity)	LF	28	$	$
5.0	STRUCTURAL METALS	NOT	USED		
6.0	CARPENTRY	NOT	USED		
7.0	FLASHING AND MOISTURE PROTECTION				

7.1	Provide new sealant at window/door perimeter joints as indicated on drawings by Repair Note R11.	LF	202	$	$
7.2	Roofing Replacement at Roof Area IP-1, including Asbestos Remediation in accordance with Specification Section 02 82 00	LS	1	$	$
8.0	DOORS AND WINDOWS				
9.0	FINISHES	NOT	USED		
BASE BID #6 TOTAL				$	

G. Lump Sum Amount for Base Bid #7 for LIBERTY PUMPING STATION

BASE BID #7 – Liberty Pumping Station					
LOCATION: 2675 W. Liberty Street, Ann Arbor, MI 48103					
	Description	Units	Quantity	Unit Cost	Extended Cost
1.0	GENERAL				
1.1	General Conditions (Max 10%)	LS	1		$
1.2	Mobilization (Max 10%)	LS	1		$
1.3	Masonry Replacement Allowance	LS	1		$ 12,500
1.4	Certified Payroll Compliance and Reporting	LS	1		$
2.0	SITE PREPARATION / DEMOLITION	NOT	USED		
3.0	CONCRETE				
4.0	MASONRY				
4.1	Re-point all cracked/weathered mortar joints at areas indicated on drawings by Repair Note R1.1 (Allowable Quantity)	SF	120	$	$
4.2	Brick Rebuild/Replacement (Allowable Quantity for areas indicated on drawings by Repair Note R1.1)	SF	30	$	$
5.0	STRUCTURAL METALS	NOT	USED		
6.0	CARPENTRY	NOT	USED		
7.0	FLASHING AND MOISTURE PROTECTION				
7.1	Provide new sealant at window/door perimeter joints as indicated on drawings by Repair Note R11.	LF	68	$	$
7.2	Roofing Replacement at Roof Area LP-1, including Asbestos Remediation in accordance with Specification Section 02 82 00	LS	1	$	$
8.0	DOORS AND WINDOWS	NOT	USED		
9.0	FINISHES	NOT	USED		
BASE BID #7 TOTAL				$	

H. Lump Sum Amount for Base Bid #8 for NORTH CAMPUS PUMPING STATION

BASE BID #8 – North Campus Pumping Station					
LOCATION: 1800 Beal Avenue, Ann Arbor, MI 48105					
	Description	Units	Quantity	Unit Cost	Extended Cost
1.0	GENERAL				
1.1	General Conditions (Max 10%)	LS	1		$
1.2	Mobilization (Max 10%)	LS	1		$

1.3	Masonry Replacement Allowance	LS	1		$ 12,500
1.4	Certified Payroll Compliance and Reporting	LS	1		$
2.0	SITE PREPARATION / DEMOLITION	NOT	USED		
3.0	CONCRETE	NOT	USED		
4.0	MASONRY				
4.1	Re-point all cracked/weathered mortar joints at areas indicated on drawings by Repair Note R1.1 (Allowable Quantity)	SF	150	$	$
4.2	Brick Rebuild/Replacement (Allowable Quantity for areas indicated on drawings by Repair Note R1.1)	SF	30	$	$
4.3	Provide steel lintel restoration as indicated on drawings by Repair Note R6.	LF	9	$	$
4.4	Provide new sealant and backer rod at expansion/control joints as indicated on drawings by Repair Note R8 (Allowable Quantity)	LF	43	$	$
5.0	STRUCTURAL METALS	NOT	USED		
6.0	CARPENTRY	NOT	USED		
7.0	FLASHING AND MOISTURE PROTECTION				
7.1	Provide new sealant at window/door perimeter joints as indicated on drawings by Repair Note R11.	LF	64	$	$
7.2	Roofing Replacement at Roof Area – NC-1	LS	1	$	$
8.0	DOORS AND WINDOWS	NOT	USED		
9.0	FINISHES	NOT	USED		
BASE BID #8 TOTAL				$	

I. Lump Sum Amount for Base Bid #9 for SUPERIOR HYDROELECTRIC

BASE BID #9 – Superior Hydroelectric					
LOCATION: 6000 First Street, Superior Township, MI 48198					
	Description	Units	Quantity	Unit Cost	Extended Cost
1.0	GENERAL				
1.1	General Conditions (Max 10%)	LS	1		$
1.2	Mobilization (Max 10%)	LS	1		$
1.3	Masonry Replacement Allowance	LS	1		$ 12,500
1.4	Certified Payroll Compliance and Reporting	LS	1		$
2.0	SITE PREPARATION / DEMOLITION	NOT	USED		
3.0	CONCRETE				
3.1	Provide concrete patching at delaminated areas of concrete/precast walls as indicated on drawings by Repair Note R12 (Allowable Quantity)	SF	20	$	$
3.2	Provide crack injection repair at cracks in concrete/precast walls as indicated on drawings by Repair Note R13 (Allowable Quantity)	LF	40	$	$
3.3	Provide new sealant and backer rod at expansion/control joints as indicated on drawings by Repair Note R8 (Allowable Quantity)	LF	242	$	$
4.0	MASONRY				
5.0	STRUCTURAL METALS	NOT	USED		
6.0	CARPENTRY	NOT	USED		

7.0	FLASHING AND MOISTURE PROTECTION				
7.1	Provide new sealant at window/door perimeter joints as indicated on drawings by Repair Note R11.	LF	56	$	$
7.2	Roofing Replacement at Roof Area SH-1	LS	1		
8.0	DOORS AND WINDOWS	NOT	USED		
9.0	FINISHES				
9.1	Apply Elastomeric Coating at concrete wall surfaces as indicated on drawings by Repair Note R16.	SF	2,750	$	$
BASE BID #9 TOTAL				$	

J. Alternate Bids:

1. Requirements:
   a. The Bidder is required to provide a bid price for each Alternate Work Item that includes any change in cost that may be incurred, or adjustment that may be required, if Alternate Work Items are added to the scope of the project. No subsequent "extras" will be considered for coordination or incidentals required to complete Alternate Bid Work Items.
   b. All selected Alternate Work Items must be completed within the contract schedule included in Part K of this Section.

2. Alternate Bid – Item #1 – Window Replacement at remainder of windows at Filter Gallery Clerestory (1144sf): $_____
   Working days to complete: (days) _____

3. Alternate Bid – Item #2 – Window Replacement at Penthouse (74sf): $ _____
   Working days to complete: (days) _____

4. Alternate Bid – Item #3 – Window Replacement at Tower (420sf): $ _____
   Working days to complete: (days) _____

5. Alternate Bid – Item #4 – Exterior Wall Restoration Work on Carbon House (South, East and West Elevations) $ _____
   Working days to complete: (days) _____

6. Alternate Bid – Item #5 – Drinking Fountain Tile Alternate (+/-50sf): $ _____
   Working days to complete: (days) _____

7. Alternate Bid – Item #6 – Credit to Base Bid #1 if asbestos is not present for Items 7.3 and 7.4: $ _____
   Working days to complete: (days) _____

K. Schedule

1. The Bidder agrees that the Work will be substantially and fully completed on or before the dates specified under Article III of the Contract, Time of Completion, page C-2. Anticipated Notice to Proceed is April/May 2019.

2. Any exceptions to this schedule can proposed by the prospective bidder in Section 3 – Time Alternate, page BF-14.

3. The Bidder agrees to have all labor, materials, equipment, etc., available to start within 14 calendar days of executing a Contract with the Owner.

Unit Price Bid

L. Unit Pricing

1. Unit prices will be used to determine the cost for Work that is not inclusive or a part of the Base Bid and/or Alternate Work items, for unknown items which may be incorporated into the contract sum by way of a Change Order as determined by the Owner.

2. Unit prices will be used to determine the amount to be added to, or deducted from, the contract sum for minor adjustments to the specified scope of Work. Owner will have final determination of what constitutes minor adjustments to the contract sum.

3. Roofing Unit prices shall be provided in accordance with the materials and procedures specified (including labor, material, overhead, profit and taxes) to remove/dispose of existing materials and provide and install the following:

Metal deck replacement	$_____/S.F.
Metal deck repair	$_____/S.F.
Concrete deck repair	$_____/S.F.
Deck anti-corrosive treatment	$_____/S.F.
Roof membrane/insulation replacement	$_____/S.F.
New roof drains with service connection to existing piping	$_____/drain
New roof drains without service connection	$_____/drain
Drain insert	$_____/drain
Limestone Coping replacement	$_____/L.F.
Wood blocking replacement	
1 x 4	$_____/L.F.
1 x 6	$_____/L.F.
1 x 8	$_____/L.F.
2 x 4	$_____/L.F.
2 x 6	$_____/L.F.
2 x 8	$_____/L.F.
2 x 10	$_____/L.F.
4 x 4 cant	$_____/L.F.
2 x 2 cant	$_____/L.F.
3/4" plywood	$_____/L.F.
A.C.R.M removal and disposal	$_____/C.YD.
Walkway pads	$_____/unit
Walkway pads	$_____/L.F.

Perform other roof/repair work as directed	
Time and material mark-up (include labor, equip. etc.)	$_____/HR.
Material mark-up	$_____/%

4. Exterior Wall Restoration Unit prices shall be provided in accordance with the materials and procedures specified (including labor, material, overhead, profit and taxes) to remove/dispose of existing materials and to provide specific repair. The Unit Prices submitted on the Bid Tables above will be used for additions or deductions to repair quantities.

BID FORM

Section 2 – Material, Equipment and Environmental Alternates

The Base Bid proposal price shall include materials and equipment selected from the designated items and manufacturers listed in the bidding documents. This is done to establish uniformity in bidding and to establish standards of quality for the items named.

If the Contractor wishes to quote alternate items for consideration by the City, it may do so under this Section. A complete description of the item and the proposed price differential must be provided. Unless approved at the time of award, substitutions where items are specifically named will be considered only as a negotiated change in Contract Sum.

If an environmental alternative is bid the City strongly encourages bidders to provide recent examples of product testing and previous successful use for the City to properly evaluate the environmental alternative. Testing data from independent accredited organizations are strongly preferred.

Item Number	Description	Add/Deduct Amount

If the Bidder does not suggest any material or equipment alternate, the Bidder **MUST** complete the following statement:

For the work outlined in this request for bid, the bidder does NOT propose any material or equipment alternate under the Contract.

Signature of Authorized Representative of Bidder _____ Date _____

BID FORM

Section 3 - Time Alternate

If the Bidder takes exception to the time stipulated in Article III of the Contract, Time of Completion, page C-1, it is requested to stipulate below its proposed time for performance of the work. Consideration will be given to time in evaluating bids.

If the Bidder does not suggest any time alternate, the Bidder **MUST** complete the following statement:

For the work outlined in this request for bid, the bidder does NOT propose any time alternate under the Contract.

Signature of Authorized Representative of Bidder _____Date _____

BID FORM

Section 4 - Major Subcontractors

For purposes of this Contract, a Subcontractor is anyone (other than the Contractor) who performs work (other than or in addition to the furnishing of materials, plans or equipment) at or about the construction site, directly or indirectly for or on behalf of the Contractor (and whether or not in privity of Contract with the Contractor), but shall not include any individual who furnishes merely the individual's own personal labor or services.

Contractor agrees that all subcontracts entered into by the Contractor shall contain similar wage provision to Section 4 of the General Conditions covering subcontractor's employees who perform work on this contract.

For the work outlined in these documents the Bidder expects to engage the following major subcontractors to perform the work identified:

Subcontractor (Name and Address)	Work	Amount
	Roofing Contractor	
	Masonry Contractor	
	Roofing Manufacturer	
	Window Manufacturer	
	Interior Renovations Contractor	

If the Bidder does not expect to engage any major subcontractor, the Bidder **MUST** complete the following statement:

For the work outlined in this request for bid, the bidder does NOT expect to engage any major subcontractor to perform work under the Contract.

Signature of Authorized Representative of Bidder_____ Date _____

BID FORM

Section 5 – References

GENERAL CONTRACTOR (if applicable) Name: _____

Include a minimum of three (3) references from similar projects involving building construction at similar facilities completed within the last seven (7) years.

[Refer also to Instructions to Bidders for additional requirements, if any]

1) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

2) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

3) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

BID FORM

Section 5 – References

ROOFING CONTRACTOR Name: _____

Include a minimum of three (3) references from similar projects involving roofing replacement at similar facilities completed within the last seven (7) years.

[Refer also to Instructions to Bidders for additional requirements, if any]

1) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

2) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

3) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

BID FORM

Section 5 – References

MASONRY CONTRACTOR Name: _____

Include a minimum of three (3) references from similar projects involving masonry repairs at similar facilities completed within the last seven (7) years.

[Refer also to Instructions to Bidders for additional requirements, if any]

1) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

2) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

3) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

BID FORM

Section 5 – References

INTERIOR RENOVATIONS CONTRACTOR Name: _____

Include a minimum of three (3) references from similar projects involving interior finishes at similar facilities completed within the last seven (7) years.

[Refer also to Instructions to Bidders for additional requirements, if any]

1) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

2) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

3) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

SAMPLE STANDARD CONTRACT

If a contract is awarded, the selected contractor will be required to adhere to a set of general contract provisions which will become a part of any formal agreement. These provisions are general principles which apply to all contractors of service to the City of Ann Arbor such as the following:

CONTRACT

THIS AGREEMENT is made on the _____ day of _____, 201_, between the CITY OF ANN ARBOR, a Michigan Municipal Corporation, 301 East Huron Street, Ann Arbor, Michigan 48104 ("City") and _____("Contractor")

(An individual/partnership/corporation, include state of incorporation) (Address)

Based upon the mutual promises below, the Contractor and the City agree as follows:

ARTICLE I - Scope of Work

The Contractor agrees to furnish all of the materials, equipment and labor necessary; and to abide by all the duties and responsibilities applicable to it for the project titled [Insert Title of Bid and Bid Number] in accordance with the requirements and provisions of the following documents, including all written modifications incorporated into any of the documents, which are incorporated as part of this Contract:

Non-discrimination and Living Wage Declaration of Compliance Forms (if applicable)
Vendor Conflict of Interest Form
Prevailing Wage Declaration of Compliance Form (if applicable)
Bid Forms
Contract and Exhibits
Bonds
General Conditions
Standard Specifications
Detailed Specifications
Plans
Addenda

ARTICLE II - Definitions

Administering Service Area/Unit means **Water Treatment Services Unit, ITB No. 4553**

Project means Water Treatment Plant 2018 Architectural and Structural Repairs

ARTICLE III - Time of Completion

(A) The work to be completed under this Contract shall begin immediately on the date specified in the Notice to Proceed issued by the City.

(B) The entire work for this Contract shall be completed within twenty (20) consecutive calendar months after Notice to Proceed.

(C) Failure to complete all the work within the time specified above, including any extension granted in writing by the Supervising Professional, shall obligate the Contractor to pay the City, as liquidated damages and not as a penalty, an amount equal to $500 for each calendar day of delay in the completion of all the work. If

any liquidated damages are unpaid by the Contractor, the City shall be entitled to deduct these unpaid liquidated damages from the monies due the Contractor.

The liquidated damages are for the non-quantifiable aspects of any of the previously identified events and do not cover actual damages that can be shown or quantified nor are they intended to preclude recovery of actual damages in addition to the recovery of liquidated damages.

ARTICLE IV - The Contract Sum

(A) The City shall pay to the Contractor for the performance of the Contract, the lump sum price as given in the Bid Form in the amount of:

_____Dollars ($_____)

ARTICLE V - Assignment

This Contract may not be assigned or subcontracted any portion of any right or obligation under this contract without the written consent of the City. Notwithstanding any consent by the City to any assignment, Contractor shall at all times remain bound to all warranties, certifications, indemnifications, promises and performances, however described, as are required of it under this contract unless specifically released from the requirement, in writing, by the City.

ARTICLE VI - Choice of Law

This Contract shall be construed, governed, and enforced in accordance with the laws of the State of Michigan. By executing this agreement, the Contractor and the City agree to venue in a court of appropriate jurisdiction sitting within Washtenaw County for purposes of any action arising under this Contract. The parties stipulate that the venue referenced in this Contract is for convenience and waive any claim of non-convenience.

Whenever possible, each provision of the Contract will be interpreted in a manner as to be effective and valid under applicable law. The prohibition or invalidity, under applicable law, of any provision will not invalidate the remainder of the Contract.

ARTICLE VII - Relationship of the Parties

The parties of the Contract agree that it is not a Contract of employment but is a Contract to accomplish a specific result. Contractor is an independent Contractor performing services for the City. Nothing contained in this Contract shall be deemed to constitute any other relationship between the City and the Contractor.

Contractor certifies that it has no personal or financial interest in the project other than the compensation it is to receive under the Contract. Contractor certifies that it is not, and shall not become, overdue or in default to the City for any Contract, debt, or any other obligation to the City including real or personal property taxes. City shall have the right to set off any such debt against compensation awarded for services under this agreement.

ARTICLE VIII - Notice

All notices given under this Contract shall be in writing, and shall be by personal delivery or by certified mail with return receipt requested to the parties at their respective addresses as specified in the Contract Documents or other address the Contractor may specify in writing. Notice will be deemed given on the date when one of the following first occur: (1) the date of actual receipt; or (2) three days after mailing certified U.S. mail.

ARTICLE IX - Indemnification

To the fullest extent permitted by law, Contractor shall indemnify, defend and hold harmless the City, its officers, employees and agents harmless from all suits, claims, judgments and expenses including attorney's fees resulting or alleged to result, in whole or in part, from any act or omission, which is in any way connected or associated with this Contract, by the Contractor or anyone acting on the Contractor's behalf under this Contract. Contractor shall not be responsible to indemnify the City for losses or damages caused by or resulting from the City's sole negligence. The provisions of this Article shall survive the expiration or earlier termination of this contract for any reason.

ARTICLE X - Entire Agreement

This Contract represents the entire understanding between the City and the Contractor and it supersedes all prior representations, negotiations, agreements, or understandings whether written or oral. Neither party has relied on any prior representations in entering into this Contract. No terms or conditions of either party's invoice, purchase order or other administrative document shall modify the terms and conditions of this Contract, regardless of the other party's failure to object to such form. This Contract shall be binding on and shall inure to the benefit of the parties to this Contract and their permitted successors and permitted assigns and nothing in this Contract, express or implied, is intended to or shall confer on any other person or entity any legal or equitable right, benefit, or remedy of any nature whatsoever under or by reason of this Contract. This Contract may be altered, amended or modified only by written amendment signed by the City and the Contractor.

FOR CONTRACTOR

By_____

Its:_____

FOR THE CITY OF ANN ARBOR

By_____
Christopher Taylor, Mayor

By_____
Jacqueline Beaudry, City Clerk

By_____
Craig Hupy
Public Services Area Administrator

Approved as to form and content

_____
Stephen K. Postema, City Attorney

PERFORMANCE BOND

(1) _____ of _____ (referred to as "Principal"), and _____, a corporation duly authorized to do business in the State of Michigan (referred to as "Surety"), are bound to the City of Ann Arbor, Michigan (referred to as "City"), for

$ _____, the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by this bond.

(2) The Principal has entered a written Contract with the City dated _____, 201_, for: _____ _____ and this bond is given for that Contract in compliance with Act No. 213 of the Michigan Public Acts of 1963, as amended, being MCL 129.201 et seq.

(3) Whenever the Principal is declared by the City to be in default under the Contract, the Surety may promptly remedy the default or shall promptly:

(a) complete the Contract in accordance with its terms and conditions; or

(b) obtain a bid or bids for submission to the City for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, arrange for a Contract between such bidder and the City, and make available, as work progresses, sufficient funds to pay the cost of completion less the balance of the Contract price; but not exceeding, including other costs and damages for which Surety may be liable hereunder, the amount set forth in paragraph 1.

(4) Surety shall have no obligation to the City if the Principal fully and promptly performs under the Contract.

(5) Surety agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder, or the specifications accompanying it shall in any way affect its obligations on this bond, and waives notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work, or to the specifications.

SIGNED AND SEALED this _____ day of _____, 201_.

_____	_____
(Name of Surety Company)	(Name of Principal)
By _____	By _____
(Signature)	(Signature)
Its _____	Its _____
(Title of Office)	(Title of Office)
Approved as to form:	Name and address of agent:
_____	_____
Stephen K. Postema, City Attorney	_____
	_____

LABOR AND MATERIAL BOND

(1) _____

of _____(referred to as "Principal"), and _____, a corporation duly authorized to do business in the State of Michigan, (referred to as "Surety"), are bound to the City of Ann Arbor, Michigan (referred to as "City"), for the use and benefit of claimants as defined in Act 213 of Michigan Public Acts of 1963, as amended, being MCL 129.201 et seq., in the amount of

$ _____, for the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by this bond.

(2) The Principal has entered a written Contract with the City, dated _____, 201_, for _____

_____; and this bond is given for that Contract in compliance with Act No. 213 of the Michigan Public Acts of 1963 as amended;

(3) If the Principal fails to promptly and fully repay claimants for labor and material reasonably required under the Contract, the Surety shall pay those claimants.

(4) Surety's obligations shall not exceed the amount stated in paragraph 1, and Surety shall have no obligation if the Principal promptly and fully pays the claimants.

SIGNED AND SEALED this _____ day of _____, 201_

_____
(Name of Surety Company)

By _____
(Signature)

Its _____
(Title of Office)

Approved as to form:

_____
Stephen K. Postema, City Attorney

_____
(Name of Principal)

By _____
(Signature)

Its _____
(Title of Office)

Name and address of agent:

_____

_____

_____

GENERAL CONDITIONS

Section 1 - Execution, Correlation and Intent of Documents

The contract documents shall be signed in 2 copies by the City and the Contractor.

The contract documents are complementary and what is called for by any one shall be binding. The intention of the documents is to include all labor and materials, equipment and transportation necessary for the proper execution of the work. Materials or work described in words which so applied have a well-known technical or trade meaning have the meaning of those recognized standards.

In case of a conflict among the contract documents listed below in any requirement(s), the requirement(s) of the document listed first shall prevail over any conflicting requirement(s) of a document listed later.

(1) Addenda in reverse chronological order; (2) Detailed Specifications; (3) Standard Specifications; (4) Plans; (5) General Conditions; (6) Contract; (7) Bid Forms; (8) Bond Forms; (9) Bid.

Section 2 - Order of Completion

The Contractor shall submit with each invoice, and at other times reasonably requested by the Supervising Professional, schedules showing the order in which the Contractor proposes to carry on the work. They shall include the dates at which the Contractor will start the several parts of the work, the estimated dates of completion of the several parts, and important milestones within the several parts.

Section 3 - Familiarity with Work

The Bidder or its representative shall make personal investigations of the site of the work and of existing structures and shall determine to its own satisfaction the conditions to be encountered, the nature of the ground, the difficulties involved, and all other factors affecting the work proposed under this Contract. The Bidder to whom this Contract is awarded will not be entitled to any additional compensation unless conditions are clearly different from those which could reasonably have been anticipated by a person making diligent and thorough investigation of the site.

The Bidder shall immediately notify the City upon discovery, and in every case prior to submitting its Bid, of every error or omission in the bidding documents that would be identified by a reasonably competent, diligent Bidder. In no case will a Bidder be allowed the benefit of extra compensation or time to complete the work under this Contract for extra expenses or time spent as a result of the error or omission.

Section 4 - Wage Requirements

Under this Contract, the Contractor shall conform to Chapter 14 of Title I of the Code of the City of Ann Arbor as amended; which in part states "...that all craftsmen, mechanics and laborers employed directly on the site in connection with said improvements, including said employees of subcontractors, shall receive the prevailing wage for the corresponding classes of craftsmen,

mechanics and laborers, as determined by statistics for the Ann Arbor area compiled by the United States Department of Labor. At the request of the City, any contractor or subcontractor shall provide satisfactory proof of compliance with the contract provisions required by the Section.

Pursuant to Resolution R-16-469 all public improvement contractors are subject to prevailing wage and will be required to provide to the City payroll records sufficient to demonstrate compliance with the prevailing wage requirements. A sample Prevailing Wage Form is provided in the Appendix herein for reference as to what will be expected from contractors. Use of the Prevailing Wage Form provided in the Appendix section or a City-approved equivalent will be required along with wage rate interviews.

Where the Contract and the Ann Arbor City Ordinance are silent as to definitions of terms required in determining contract compliance with regard to prevailing wages, the definitions provided in the Davis-Bacon Act as amended (40 U.S.C. 278-a to 276-a-7) for the terms shall be used.

If the Contractor is a "covered employer" as defined in Chapter 23 of the Ann Arbor City Code, the Contractor agrees to comply with the living wage provisions of Chapter 23 of the Ann Arbor City Code. The Contractor agrees to pay those employees providing Services to the City under this Agreement a "living wage," as defined in Section 1:815 of the Ann Arbor City Code, as adjusted in accordance with Section 1:815(3); to post a notice approved by the City of the applicability of Chapter 23 in every location in which regular or contract employees providing services under this Agreement are working; to maintain records of compliance; if requested by the City, to provide documentation to verify compliance; to take no action that would reduce the compensation, wages, fringe benefits, or leave available to any employee or person contracted for employment in order to pay the living wage required by Section 1:815; and otherwise to comply with the requirements of Chapter 23.

Contractor agrees that all subcontracts entered into by the Contractor shall contain similar wage provision covering subcontractor's employees who perform work on this contract.

Section 5 - Non-Discrimination

The Contractor agrees to comply, and to require its subcontractor(s) to comply, with the nondiscrimination provisions of MCL 37.2209. The Contractor further agrees to comply with the provisions of Section 9:158 of Chapter 112 of Title IX of the Ann Arbor City Code, and to assure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity.

Section 6 - Materials, Appliances, Employees

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation, and other facilities necessary or used for the execution and completion of the work. Unless otherwise specified, all materials incorporated in the permanent work shall be new, and both workmanship and materials shall be of the highest quality. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials.

The Contractor shall at all times enforce strict discipline and good order among its employees, and shall seek to avoid employing on the work any unfit person or anyone not skilled in the work assigned.

Adequate sanitary facilities shall be provided by the Contractor.

Section 7 - Qualifications for Employment

The Contractor shall employ competent laborers and mechanics for the work under this Contract. For work performed under this Contract, employment preference shall be given to qualified local residents.

Section 8 - Royalties and Patents

The Contractor shall pay all royalties and license fees. It shall defend all suits or claims for infringements of any patent rights and shall hold the City harmless from loss on account of infringement except that the City shall be responsible for all infringement loss when a particular process or the product of a particular manufacturer or manufacturers is specified, unless the City has notified the Contractor prior to the signing of the Contract that the particular process or product is patented or is believed to be patented.

Section 9 - Permits and Regulations

The Contractor must secure and pay for all permits, permit or plan review fees and licenses necessary for the prosecution of the work. These include but are not limited to City building permits, right-of-way permits, lane closure permits, right-of-way occupancy permits, and the like. The City shall secure and pay for easements shown on the plans unless otherwise specified.

The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the contract documents are at variance with those requirements, it shall promptly notify the Supervising Professional in writing, and any necessary changes shall be adjusted as provided in the Contract for changes in the work.

Section 10 - Protection of the Public and of Work and Property

The Contractor is responsible for the means, methods, sequences, techniques and procedures of construction and safety programs associated with the work contemplated by this contract. The Contractor, its agents or sub-contractors, shall comply with the "General Rules and Regulations for the Construction Industry" as published by the Construction Safety Commission of the State of Michigan and to all other local, State and National laws, ordinances, rules and regulations pertaining to safety of persons and property.

The Contractor shall take all necessary and reasonable precautions to protect the safety of the public. It shall continuously maintain adequate protection of all work from damage, and shall take all necessary and reasonable precautions to adequately protect all public and private property from injury or loss arising in connection with this Contract. It shall make good any damage, injury or loss to its work and to public and private property resulting from lack of reasonable protective precautions, except as may be due to errors in the contract documents, or caused by agents or employees of the City. The Contractor shall obtain and maintain sufficient insurance to cover damage to any City property at the site by any cause.

In an emergency affecting the safety of life, or the work, or of adjoining property, the Contractor is, without special instructions or authorization from the Supervising Professional, permitted to act at its discretion to prevent the threatened loss or injury. It shall also so act, without appeal, if authorized or instructed by the Supervising Professional.

Any compensation claimed by the Contractor for emergency work shall be determined by agreement or in accordance with the terms of Claims for Extra Cost - Section 15.

Section 11 - Inspection of Work

The City shall provide sufficient competent personnel for the inspection of the work.

The Supervising Professional shall at all times have access to the work whenever it is in preparation or progress, and the Contractor shall provide proper facilities for access and for inspection.

If the specifications, the Supervising Professional's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give the Supervising Professional timely notice of its readiness for inspection, and if the inspection is by an authority other than the Supervising Professional, of the date fixed for the inspection. Inspections by the Supervising Professional shall be made promptly, and where practicable at the source of supply. If any work should be covered up without approval or consent of the Supervising Professional, it must, if required by the Supervising Professional, be uncovered for examination and properly restored at the Contractor's expense.

Re-examination of any work may be ordered by the Supervising Professional, and, if so ordered, the work must be uncovered by the Contractor. If the work is found to be in accordance with the contract documents, the City shall pay the cost of re-examination and replacement. If the work is not in accordance with the contract documents, the Contractor shall pay the cost.

Section 12 - Superintendence

The Contractor shall keep on the work site, during its progress, a competent superintendent and any necessary assistants, all satisfactory to the Supervising Professional. The superintendent will be responsible to perform all on-site project management for the Contractor. The superintendent shall be experienced in the work required for this Contract. The superintendent shall represent the Contractor and all direction given to the superintendent shall be binding as if given to the Contractor. Important directions shall immediately be confirmed in writing to the Contractor. Other directions will be confirmed on written request. The Contractor shall give efficient superintendence to the work, using its best skill and attention.

Section 13 - Changes in the Work

The City may make changes to the quantities of work within the general scope of the Contract at any time by a written order and without notice to the sureties. If the changes add to or deduct from the extent of the work, the Contract Sum shall be adjusted accordingly. All the changes shall be executed under the conditions of the original Contract except that any claim for extension of time caused by the change shall be adjusted at the time of ordering the change.

In giving instructions, the Supervising Professional shall have authority to make minor changes in the work not involving extra cost and not inconsistent with the purposes of the work, but otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a written order by the Supervising Professional, and no claim for an addition to the Contract Sum shall be valid unless the additional work was ordered in writing.

The Contractor shall proceed with the work as changed and the value of the work shall be determined as provided in Claims for Extra Cost - Section 15.

Section 14 - Extension of Time

Extension of time stipulated in the Contract for completion of the work will be made if and as the

Supervising Professional may deem proper under any of the following circumstances:

(1) When work under an extra work order is added to the work under this Contract;

(2) When the work is suspended as provided in Section 20;

(3) When the work of the Contractor is delayed on account of conditions which could not have been foreseen, or which were beyond the control of the Contractor, and which were not the result of its fault or negligence;

(4) Delays in the progress of the work caused by any act or neglect of the City or of its employees or by other Contractors employed by the City;

(5) Delay due to an act of Government;

(6) Delay by the Supervising Professional in the furnishing of plans and necessary information;

(7) Other cause which in the opinion of the Supervising Professional entitles the Contractor to an extension of time.

The Contractor shall notify the Supervising Professional within 7 days of an occurrence or conditions which, in the Contractor's opinion, entitle it to an extension of time. The notice shall be in writing and submitted in ample time to permit full investigation and evaluation of the Contractor's claim. The Supervising Professional shall acknowledge receipt of the Contractor's notice within 7 days of its receipt. Failure to timely provide the written notice shall constitute a waiver by the Contractor of any claim.

In situations where an extension of time in contract completion is appropriate under this or any other section of the contract, the Contractor understands and agrees that the only available adjustment for events that cause any delays in contract completion shall be extension of the required time for contract completion and that there shall be no adjustments in the money due the Contractor on account of the delay.

Section 15 - Claims for Extra Cost

If the Contractor claims that any instructions by drawings or other media issued after the date of the Contract involved extra cost under this Contract, it shall give the Supervising Professional written notice within 7 days after the receipt of the instructions, and in any event before proceeding to execute the work, except in emergency endangering life or property. The procedure shall then be as provided for Changes in the Work-Section l3. No claim shall be valid unless so made.

If the Supervising Professional orders, in writing, the performance of any work not covered by the contract documents, and for which no item of work is provided in the Contract, and for which no unit price or lump sum basis can be agreed upon, then the extra work shall be done on a Cost-Plus-Percentage basis of payment as follows:

(1) The Contractor shall be reimbursed for all reasonable costs incurred in doing the work, and shall receive an additional payment of 15% of all the reasonable costs to cover both its indirect overhead costs and profit;

(2) The term "Cost" shall cover all payroll charges for employees and supervision required under the specific order, together with all worker's compensation, Social Security, pension and retirement allowances and social insurance, or other regular payroll charges on same;

the cost of all material and supplies required of either temporary or permanent character; rental of all power-driven equipment at agreed upon rates, together with cost of fuel and supply charges for the equipment; and any costs incurred by the Contractor as a direct result of executing the order, if approved by the Supervising Professional;

(3) If the extra is performed under subcontract, the subcontractor shall be allowed to compute its charges as described above. The Contractor shall be permitted to add an additional charge of 5% percent to that of the subcontractor for the Contractor's supervision and contractual responsibility;

(4) The quantities and items of work done each day shall be submitted to the Supervising Professional in a satisfactory form on the succeeding day, and shall be approved by the Supervising Professional and the Contractor or adjusted at once;

(5) Payments of all charges for work under this Section in any one month shall be made along with normal progress payments. Retainage shall be in accordance with Progress Payments-Section 16.

No additional compensation will be provided for additional equipment, materials, personnel, overtime or special charges required to perform the work within the time requirements of the Contract.

When extra work is required and no suitable price for machinery and equipment can be determined in accordance with this Section, the hourly rate paid shall be 1/40 of the basic weekly rate listed in the Rental Rate Blue Book published by Dataquest Incorporated and applicable to the time period the equipment was first used for the extra work. The hourly rate will be deemed to include all costs of operation such as bucket or blade, fuel, maintenance, "regional factors", insurance, taxes, and the like, but not the costs of the operator.

Section 16 - Progress Payments

The Contractor shall submit each month, or at longer intervals, if it so desires, an invoice covering work performed for which it believes payment, under the Contract terms, is due. The submission shall be to the City's Finance Department - Accounting Division. The Supervising Professional will, within 10 days following submission of the invoice, prepare a certificate for payment for the work in an amount to be determined by the Supervising Professional as fairly representing the acceptable work performed during the period covered by the Contractor's invoice. To insure the proper performance of this Contract, the City will retain a percentage of the estimate in accordance with Act 524, Public Acts of 1980. The City will then, following the receipt of the Supervising Professional's Certificate, make payment to the Contractor as soon as feasible, which is anticipated will be within 15 days.

An allowance may be made in progress payments if substantial quantities of permanent material have been delivered to the site but not incorporated in the completed work if the Contractor, in the opinion of the Supervising Professional, is diligently pursuing the work under this Contract. Such materials shall be properly stored and adequately protected. Allowance in the estimate shall be at the invoice price value of the items. Notwithstanding any payment of any allowance, all risk of loss due to vandalism or any damages to the stored materials remains with the Contractor.

In the case of Contracts which include only the Furnishing and Delivering of Equipment, the payments shall be; 60% of the Contract Sum upon the delivery of all equipment to be furnished, or in the case of delivery of a usable portion of the equipment in advance of the total equipment delivery, 60% of the estimated value of the portion of the equipment may be paid upon its delivery in advance of the time of the remainder of the equipment to be furnished; 30% of the Contract

Sum upon completion of erection of all equipment furnished, but not later than 60 days after the date of delivery of all of the equipment to be furnished; and payment of the final 10% on final completion of erection, testing and acceptance of all the equipment to be furnished; but not later than l80 days after the date of delivery of all of the equipment to be furnished, unless testing has been completed and shows the equipment to be unacceptable.

With each invoice for periodic payment, the Contractor shall enclose a Contractor's Declaration - Section 43, and an updated project schedule per Order of Completion - Section 2.

Section 17 - Deductions for Uncorrected Work

If the Supervising Professional decides it is inexpedient to correct work that has been damaged or that was not done in accordance with the Contract, an equitable deduction from the Contract price shall be made.

Section 18 - Correction of Work Before Final Payment

The Contractor shall promptly remove from the premises all materials condemned by the Supervising Professional as failing to meet Contract requirements, whether incorporated in the work or not, and the Contractor shall promptly replace and re-execute the work in accordance with the Contract and without expense to the City and shall bear the expense of making good all work of other contractors destroyed or damaged by the removal or replacement.

If the Contractor does not remove the condemned work and materials within l0 days after written notice, the City may remove them and, if the removed material has value, may store the material at the expense of the Contractor. If the Contractor does not pay the expense of the removal within 10 days thereafter, the City may, upon 10 days written notice, sell the removed materials at auction or private sale and shall pay to the Contractor the net proceeds, after deducting all costs and expenses that should have been borne by the Contractor. If the removed material has no value, the Contractor must pay the City the expenses for disposal within 10 days of invoice for the disposal costs.

The inspection or lack of inspection of any material or work pertaining to this Contract shall not relieve the Contractor of its obligation to fulfill this Contract and defective work shall be made good. Unsuitable materials may be rejected by the Supervising Professional notwithstanding that the work and materials have been previously overlooked by the Supervising Professional and accepted or estimated for payment or paid for. If the work or any part shall be found defective at any time before the final acceptance of the whole work, the Contractor shall forthwith make good the defect in a manner satisfactory to the Supervising Professional. The judgment and the decision of the Supervising Professional as to whether the materials supplied and the work done under this Contract comply with the requirements of the Contract shall be conclusive and final.

Section 19 - Acceptance and Final Payment

Upon receipt of written notice that the work is ready for final inspection and acceptance, the Supervising Professional will promptly make the inspection. When the Supervising Professional finds the work acceptable under the Contract and the Contract fully performed, the Supervising Professional will promptly sign and issue a final certificate stating that the work required by this Contract has been completed and is accepted by the City under the terms and conditions of the Contract. The entire balance found to be due the Contractor, including the retained percentage, shall be paid to the Contractor by the City within 30 days after the date of the final certificate.

Before issuance of final certificates, the Contractor shall file with the City:

(1) The consent of the surety to payment of the final estimate;
(2) The Contractor's Affidavit in the form required by Section 44.

In case the Affidavit or consent is not furnished, the City may retain out of any amount due the Contractor, sums sufficient to cover all lienable claims.

The making and acceptance of the final payment shall constitute a waiver of all claims by the City except those arising from:

(1) unsettled liens;
(2) faulty work appearing within 12 months after final payment;
(3) hidden defects in meeting the requirements of the plans and specifications;
(4) manufacturer's guarantees.

It shall also constitute a waiver of all claims by the Contractor, except those previously made and still unsettled.

Section 20 - Suspension of Work

The City may at any time suspend the work, or any part by giving 5 days notice to the Contractor in writing. The work shall be resumed by the Contractor within 10 days after the date fixed in the written notice from the City to the Contractor to do so. The City shall reimburse the Contractor for expense incurred by the Contractor in connection with the work under this Contract as a result of the suspension.

If the work, or any part, shall be stopped by the notice in writing, and if the City does not give notice in writing to the Contractor to resume work at a date within 90 days of the date fixed in the written notice to suspend, then the Contractor may abandon that portion of the work suspended and will be entitled to the estimates and payments for all work done on the portions abandoned, if any, plus 10% of the value of the work abandoned, to compensate for loss of overhead, plant expense, and anticipated profit.

Section 21 - Delays and the City's Right to Terminate Contract

If the Contractor refuses or fails to prosecute the work, or any separate part of it, with the diligence required to insure completion, ready for operation, within the allowable number of consecutive calendar days specified plus extensions, or fails to complete the work within the
required time, the City may, by written notice to the Contractor, terminate its right to proceed with the work or any part of the work as to which there has been delay. After providing the notice the City may take over the work and prosecute it to completion, by contract or otherwise, and the Contractor and its sureties shall be liable to the City for any excess cost to the City. If the Contractor's right to proceed is terminated, the City may take possession of and utilize in completing the work, any materials, appliances and plant as may be on the site of the work and useful for completing the work. The right of the Contractor to proceed shall not be terminated or the Contractor charged with liquidated damages where an extension of time is granted under Extension of Time - Section 14.

If the Contractor is adjudged a bankrupt, or if it makes a general assignment for the benefit of creditors, or if a receiver is appointed on account of its insolvency, or if it persistently or repeatedly refuses or fails except in cases for which extension of time is provided, to supply enough properly skilled workers or proper materials, or if it fails to make prompt payments to subcontractors or for material or labor, or persistently disregards laws, ordinances or the instructions of the Supervising Professional, or otherwise is guilty of a substantial violation of any provision of the Contract, then the City, upon the certificate of the Supervising Professional that sufficient cause exists to justify

such action, may, without prejudice to any other right or remedy and after giving the Contractor 3 days written notice, terminate this Contract. The City may then take possession of the premises and of all materials, tools and appliances thereon and without prejudice to any other remedy it may have, make good the deficiencies or finish the work by whatever method it may deem expedient, and deduct the cost from the payment due the Contractor. The Contractor shall not be entitled to receive any further payment until the work is finished. If the expense of finishing the work, including compensation for additional managerial and administrative services exceeds the unpaid balance of the Contract Sum, the Contractor and its surety are liable to the City for any excess cost incurred. The expense incurred by the City, and the damage incurred through the Contractor's default, shall be certified by the Supervising Professional.

Section 22 - Contractor's Right to Terminate Contract

If the work should be stopped under an order of any court, or other public authority, for a period of 3 months, through no act or fault of the Contractor or of anyone employed by it, then the Contractor may, upon 7 days written notice to the City, terminate this Contract and recover from the City payment for all acceptable work executed plus reasonable profit.

Section 23 - City's Right To Do Work

If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the City, 3 days after giving written notice to the Contractor and its surety may, without prejudice to any other remedy the City may have, make good the deficiencies and may deduct the cost from the payment due to the Contractor.

Section 24 - Removal of Equipment and Supplies

In case of termination of this Contract before completion, from any or no cause, the Contractor, if notified to do so by the City, shall promptly remove any part or all of its equipment and supplies from the property of the City, failing which the City shall have the right to remove the equipment and supplies at the expense of the Contractor.

The removed equipment and supplies may be stored by the City and, if all costs of removal and storage are not paid by the Contractor within 10 days of invoicing, the City upon 10 days written notice may sell the equipment and supplies at auction or private sale, and shall pay the Contractor the net proceeds after deducting all costs and expenses that should have been borne by the Contractor and after deducting all amounts claimed due by any lien holder of the equipment or supplies.

Section 25 - Responsibility for Work and Warranties

The Contractor assumes full responsibility for any and all materials and equipment used in the construction of the work and may not make claims against the City for damages to materials and equipment from any cause except negligence or willful act of the City. Until its final acceptance, the Contractor shall be responsible for damage to or destruction of the project (except for any part covered by Partial Completion and Acceptance - Section 26). The Contractor shall make good all work damaged or destroyed before acceptance. All risk of loss remains with the Contractor until final acceptance of the work (Section 19) or partial acceptance (Section 26). The Contractor is advised to investigate obtaining its own builders risk insurance.

The Contractor shall guarantee the quality of the work for a period of one year. The Contractor shall also unconditionally guarantee the quality of all equipment and materials that are furnished and installed under the contract for a period of one year. At the end of one year after the Contractor's receipt of final payment, the complete work, including equipment and materials

furnished and installed under the contract, shall be inspected by the Contractor and the Supervising Professional. Any defects shall be corrected by the Contractor at its expense as soon as practicable but in all cases within 60 days. Any defects that are identified prior to the end of one year shall also be inspected by the Contractor and the Supervising Professional and shall be corrected by the Contractor at its expense as soon as practicable but in all cases within 60 days. The Contractor shall assign all manufacturer or material supplier warranties to the City prior to final payment. The assignment shall not relieve the Contractor of its obligations under this paragraph to correct defects.

Section 26 - Partial Completion and Acceptance

If at any time prior to the issuance of the final certificate referred to in Acceptance and Final Payment - Section 19, any portion of the permanent construction has been satisfactorily completed, and if the Supervising Professional determines that portion of the permanent construction is not required for the operations of the Contractor but is needed by the City, the Supervising Professional shall issue to the Contractor a certificate of partial completion, and immediately the City may take over and use the portion of the permanent construction described in the certificate, and exclude the Contractor from that portion.

The issuance of a certificate of partial completion shall not constitute an extension of the Contractor's time to complete the portion of the permanent construction to which it relates if the Contractor has failed to complete it in accordance with the terms of this Contract. The issuance of the certificate shall not release the Contractor or its sureties from any obligations under this Contract including bonds.

If prior use increases the cost of, or delays the work, the Contractor shall be entitled to extra compensation, or extension of time, or both, as the Supervising Professional may determine.

Section 27 - Payments Withheld Prior to Final Acceptance of Work

The City may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any certificate to the extent reasonably appropriate to protect the City from loss on account of:

(1) Defective work not remedied;

(2) Claims filed or reasonable evidence indicating probable filing of claims by other parties against the Contractor;

(3) Failure of the Contractor to make payments properly to subcontractors or for material or labor;

(4) Damage to another Contractor.

When the above grounds are removed or the Contractor provides a Surety Bond satisfactory to the City which will protect the City in the amount withheld, payment shall be made for amounts withheld under this section.

Section 28 - Contractor's Insurance

(1) The Contractor shall procure and maintain during the life of this Contract, including the guarantee period and during any warranty work, such insurance policies, including those set forth below, as will protect itself and the City from all claims for bodily injuries, death

or property damage which may arise under this Contract; whether the act(s) or omission(s) giving rise to the claim were made by the Contractor or by any subcontractor or anyone employed by them directly or indirectly. In the case of all contracts involving on-site work, the Contractor shall provide to the City, before the commencement of any work under this contract, certificates of insurance and other documentation satisfactory to the City demonstrating it has obtained the policies and endorsements required.on behalf of itself, and when requested, any subcontractor(s). The certificates of insurance endorsements and/or copies of policy language shall document that the Contractor satisfies the following minimum requirements.

(a) Worker's Compensation Insurance in accordance with all applicable state and federal statutes. Further, Employers Liability Coverage shall be obtained in the following minimum amounts:

Bodily Injury by Accident - $500,000 each accident
Bodily Injury by Disease - $500,000 each employee
Bodily Injury by Disease - $500,000 each policy limit

(b) Commercial General Liability Insurance equivalent to, as a minimum, Insurance Services Office form CG 00 01 07 98 or current equivalent. The City of Ann Arbor shall be named as an additional insured. There shall be no added exclusions or limiting endorsements specifically for the following coverages: Products and Completed Operations, Explosion, Collapse and Underground coverage or Pollution. Further there shall be no added exclusions or limiting endorsements which diminish the City's protections as an additional insured under the policy. The following minimum limits of liability are required:

$1,000,000	Each occurrence as respect Bodily Injury Liability or Property Damage Liability, or both combined.
$2,000,000	Per Job General Aggregate
$1,000,000	Personal and Advertising Injury
$2,000,000	Products and Completed Operations Aggregate

(c) Motor Vehicle Liability Insurance, including Michigan No-Fault Coverages, equivalent to, as a minimum, Insurance Services Office form CA 00 01 07 97 or current equivalent. Coverage shall include all owned vehicles, all non-owned vehicles and all hired vehicles. The City of Ann Arbor shall be named as an additional insured. There shall be no added exclusions or limiting endorsements which diminish the City's protections as an additional insured under the policy. Further, the limits of liability shall be $1,000,000 for each occurrence as respects Bodily Injury Liability or Property Damage Liability, or both combined.

(d) Umbrella/Excess Liability Insurance shall be provided to apply excess of the Commercial General Liability, Employers Liability and the Motor Vehicle coverage enumerated above, for each occurrence and for aggregate in the amount of $1,000,000.

(2) Insurance required under subsection (1)(b) and (1)(c) above shall be considered primary as respects any other valid or collectible insurance that the City may possess, including any self-insured retentions the City may have; and any other insurance the City does possess shall be considered excess insurance only and shall not be required to contribute with this insurance. Further, the Contractor agrees to waive any right of recovery by its insurer against the City.

(3) Insurance companies and policy forms are subject to approval of the City Attorney, which

approval shall not be unreasonably withheld. .Documentation must provide and demonstrate an unconditional 30 day written notice of cancellation in favor of the City of Ann Arbor. Further, the documentation must explicitly state the following: (a) the policy number; name of insurance company; name and address of the agent or authorized representative; name and address of insured; project name; policy expiration date; and specific coverage amounts; (b) any deductibles or self-insured retentions which shall be approved by the City, in its sole discretion; (c) that the policy conforms to the requirements specified Contractor shall furnish the City with satisfactory certificates of insurance and endorsements prior to commencement of any work. Upon request, the Contractor shall provide within 30 days a copy of the policy(ies) to the City. If any of the above coverages expire by their terms during the term of this Contract, the Contractor shall deliver proof of renewal and/or new policies and endorsements to the Administering Service Area/Unit at least ten days prior to the expiration date.

(4) Any Insurance provider of Contractor shall be admitted and authorized to do business in the State of Michigan and shall carry and maintain a minimum rating assigned by A.M. Best & Company's Key Rating Guide of "A-" Overall and a minimum Financial Size Category of "V". Insurance policies and certificates issued by non-admitted insurance companies are not acceptable unless approved in writing by the City.

(5) City reserves the right to require additional coverage and/or coverage amounts as may be included from time to time in the Detailed Specifications for the Project.

(6) The provisions of General Condition 28 shall survive the expiration or earlier termination of this contract for any reason.

Section 29 - Surety Bonds

Bonds will be required from the successful bidder as follows:

(1) A Performance Bond to the City of Ann Arbor for the amount of the bid(s) accepted;
(2) A Labor and Material Bond to the City of Ann Arbor for the amount of the bid(s) accepted.

Bonds shall be executed on forms supplied by the City in a manner and by a Surety Company authorized to transact business in Michigan and satisfactory to the City Attorney.

Section 30 - Damage Claims

The Contractor shall be held responsible for all damages to property of the City or others, caused by or resulting from the negligence of the Contractor, its employees, or agents during the progress of or connected with the prosecution of the work, whether within the limits of the work or elsewhere. The Contractor must restore all property injured including sidewalks, curbing, sodding, pipes, conduit, sewers or other public or private property to not less than its original condition with new work.

Section 31 - Refusal to Obey Instructions

If the Contractor refuses to obey the instructions of the Supervising Professional, the Supervising Professional shall withdraw inspection from the work, and no payments will be made for work performed thereafter nor may work be performed thereafter until the Supervising Professional shall have again authorized the work to proceed.

Section 32 - Assignment

Neither party to the Contract shall assign the Contract without the written consent of the other. The Contractor may assign any monies due to it to a third party acceptable to the City.

Section 33 - Rights of Various Interests

Whenever work being done by the City's forces or by other contractors is contiguous to work covered by this Contract, the respective rights of the various interests involved shall be established by the Supervising Professional, to secure the completion of the various portions of the work in general harmony.

The Contractor is responsible to coordinate all aspects of the work, including coordination of, and with, utility companies and other contractors whose work impacts this project.

Section 34 - Subcontracts

The Contractor shall not award any work to any subcontractor without prior written approval of the City. The approval will not be given until the Contractor submits to the City a written statement concerning the proposed award to the subcontractor. The statement shall contain all information the City may require.

The Contractor shall be as fully responsible to the City for the acts and omissions of its subcontractors, and of persons either directly or indirectly employed by them, as it is for the acts and omissions of persons directly employed by it.

The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the General Conditions and all other contract documents applicable to the work of the subcontractors and to give the Contractor the same power to terminate any subcontract that the City may exercise over the Contractor under any provision of the contract documents.

Nothing contained in the contract documents shall create any contractual relation between any subcontractor and the City.

Section 35 - Supervising Professional's Status

The Supervising Professional has the right to inspect any or all work. The Supervising Professional has authority to stop the work whenever stoppage may be appropriate to insure the proper execution of the Contract. The Supervising Professional has the authority to reject all work and materials which do not conform to the Contract and to decide questions which arise in the execution of the work.

The Supervising Professional shall make all measurements and determinations of quantities. Those measurements and determinations are final and conclusive between the parties.

Section 36 - Supervising Professional's Decisions

The Supervising Professional shall, within a reasonable time after their presentation to the Supervising Professional, make decisions in writing on all claims of the City or the Contractor and on all other matters relating to the execution and progress of the work or the interpretation of the contract documents.

Section 37 - Storing Materials and Supplies

Materials and supplies may be stored at the site of the work at locations agreeable to the City unless specific exception is listed elsewhere in these documents. Ample way for foot traffic and drainage must be provided, and gutters must, at all times, be kept free from obstruction. Traffic on streets shall be interfered with as little as possible. The Contractor may not enter or occupy with agents, employees, tools, or material any private property without first obtaining written permission from its owner. A copy of the permission shall be furnished to the Supervising Professional.

Section 38 - Lands for Work

The Contractor shall provide, at its own expense and without liability to the City, any additional land and access that may be required for temporary construction facilities or for storage of materials.

Section 39 - Cleaning Up

The Contractor shall, as directed by the Supervising Professional, remove at its own expense from the City's property and from all public and private property all temporary structures, rubbish and waste materials resulting from its operations unless otherwise specifically approved, in writing, by the Supervising Professional.

Section 40 - Salvage

The Supervising Professional may designate for salvage any materials from existing structures or underground services. Materials so designated remain City property and shall be transported or stored at a location as the Supervising Professional may direct.

Section 41 - Night, Saturday or Sunday Work

No night or Sunday work (without prior written City approval) will be permitted except in the case of an emergency and then only to the extent absolutely necessary. The City may allow night work which, in the opinion of the Supervising Professional, can be satisfactorily performed at night. Night work is any work between 8:00 p.m. and 7:00 a.m. No Saturday work will be permitted unless the Contractor gives the Supervising Professional at least 48 hours but not more than 5 days notice of the Contractor's intention to work the upcoming Saturday.

Section 42 - Sales Taxes

Under State law the City is exempt from the assessment of State Sales Tax on its direct purchases. Contractors who acquire materials, equipment, supplies, etc. for incorporation in City projects are not likewise exempt. State Law shall prevail. The Bidder shall familiarize itself with the State Law and prepare its Bid accordingly. No extra payment will be allowed under this Contract for failure of the Contractor to make proper allowance in this bid for taxes it must pay.

Section 43

CONTRACTOR'S DECLARATION

I hereby declare that I have not, during the period _____, 20__, to _____, 20 , performed any work, furnished any materials, sustained any loss, damage or delay, or otherwise done anything in addition to the regular items (or executed change orders) set forth in the Contract titled _____, for which I shall ask, demand, sue for, or claim compensation or extension of time from the City, except as I hereby make claim for additional compensation or extension of time as set forth on the attached itemized statement. I further declare that I have paid all payroll obligations related to this Contract that have become due during the above period and that all invoices related to this Contract received more than 30 days prior to this declaration have been paid in full except as listed below.

There is/is not (Contractor please circle one and strike one as appropriate) an itemized statement attached regarding a request for additional compensation or extension of time.

_____ _____
Contractor Date

By _____
(Signature)

Its _____
(Title of Office)

Past due invoices, if any, are listed below.

Section 44

CONTRACTOR'S AFFIDAVIT

The undersigned Contractor,_____, represents that on _____, 20___, it was awarded a contract by the City of Ann Arbor, Michigan to_____ under the terms and conditions of a Contract titled _____. The Contractor represents that all work has now been accomplished and the Contract is complete.

The Contractor warrants and certifies that all of its indebtedness arising by reason of the Contract has been fully paid or satisfactorily secured; and that all claims from subcontractors and others for labor and material used in accomplishing the project, as well as all other claims arising from the performance of the Contract, have been fully paid or satisfactorily settled. The Contractor agrees that, if any claim should hereafter arise, it shall assume responsibility for it immediately upon request to do so by the City of Ann Arbor.

The Contractor, for valuable consideration received, does further waive, release and relinquish any and all claims or right of lien which the Contractor now has or may acquire upon the subject premises for labor and material used in the project owned by the City of Ann Arbor.

This affidavit is freely and voluntarily given with full knowledge of the facts.

_____ _____
Contractor Date

By _____
(Signature)

Its _____
(Title of Office)

Subscribed and sworn to before me, on this _____ day of _____, 20__
_____ , _____ County, Michigan
Notary Public
_____ County, MI
My commission expires on:

SUPPLEMENTAL GENERAL CONDITIONS

General Safety Requirements

The Contractor shall be responsible for ensuring compliance with the most stringent provisions of the applicable statutes and regulations of the Michigan Occupational Safety and Health Act 154 of 1974, the Occupational Safety and Health Act of 1970, and all City of Ann Arbor safety policies. The Contractor shall flow down all these requirements to any subcontractor performing work under the contract. Should charges of violation of any of the above be issued to the Contractor in the course of the work, a copy of each charge shall be immediately forwarded to the City along with a plan to correct the violation.

Upon the failure of the Contractor to comply with any of these requirements, the City's Representative shall have the authority to stop any and all operations of the Contractor affected by such failure until such failure is remedied. No part of the time lost due to any such stop orders shall be made subject to a claim or extension of time or increase in compensation.

All materials, equipment, and supplies provided to the City of Ann Arbor must comply fully with all safety requirements as set forth by the Michigan Occupational Safety and Health Act 154 of 1974 and all applicable OSHA Standards.

STANDARD SPECIFICATIONS

All work under this contract shall be performed in accordance with the Public Services Department Standard Specifications in effect at the date of availability of the contract documents stipulated in the Bid. All work under this Contract which is not included in these Standard Specifications, or which is performed using modifications to these Standard Specifications, shall be performed in accordance with the Detailed Specifications included in these contract documents.

Standard Specifications are available online:
http://www.a2gov.org/departments/engineering/Pages/Engineering-and-Contractor-Resources.aspx

DETAILED SPECIFICATIONS

ARCHITECTURAL AND STRUCTURAL REPAIRS AND INTERIOR RENOVATION

SECTION 00 30 00

INFORMATION TO BIDDERS

PART 1 - GENERAL

1.01 BIDDER INFORMATION

A. Test data regarding existing roof system composition(s) and selective bulk sample analysis of existing membrane samples has been provided in this Section for general informational purposes only. Any test cut data provided represents point source information at the test cut location only and may not be representative of materials at other locations.

B. The Owner shall be responsible for providing, and paying for, a testing firm to perform testing of roofing materials for Asbestos Containing Materials (ACM).

C. The Contractor shall be responsible for identifying areas to be tested, coordinating the testing services with construction activities, and for acquiring/extracting test cut samples of the existing roof construction to assess, determine and verify the construction of the existing roof. All test cuts shall be documented regarding location and method of repair, and this documentation shall be submitted to the Owner.

D. Any variations in the existing construction, from the information provided, must be brought to the attention of the Consultant and Owner.

E. Contractor shall present plan for necessary ACM remediation efforts identified as a result of testing, in accordance with Section 02 82 00 - Asbestos Remediation, to the Owner for review prior to performing Work in the identified area(s).

F. Additional costs associated with asbestos abatement efforts shall be paid for by the Hazardous Material Remediation Allowance included in the Bid Form(s).

G. Unless stated elsewhere, the Contractor has the sole and final responsibility of identifying the presence of any existing asbestos containing roofing materials prior to beginning work, as well as the means and methods for its safe removal and disposal from the project.

H. Information provided to Bidders as part of this Section includes the following:

1. Test Cut Data

    a. Admin Building - Roof Area AD-3
        1) Modified Bitumen BUR System
        2) (1) Layer – 0.5 inch Wood Fiber Insulation
        3) (1) Layer - 1.5 inch Polyisocyanurate Insulation
        4) (1) Layer - 2.0 inch Polyisocyanurate Insulation
        5) Base Sheet
        6) Concrete Deck

b. Control Room - Roof Area CR-1
   1) Ballasted EPDM
   2) (1) Layer - 1.5 inch Polyisocyanurate Insulation
   3) Base Sheet
   4) Concrete Deck

c. EQ Building - Roof Area EQ-1
   1) Modified Bitumen BUR System
   2) (1) Layer – 0.5 inch Wood Fiber Insulation
   3) (1) Layer - 1.0 inch Polyisocyanurate Insulation
   4) Base Sheet
   5) Concrete Deck

d. Filter Gallery - Roof Area F-2
   1) Fully Adhered EPDM
   2) (1) Layer - 2.0 inch Polyisocyanurate Insulation
   3) Base Sheet
   4) Concrete Deck

e. Filter Gallery - Roof Area F-4
   1) Ballasted EPDM
   2) (1) Layer - 2.0 inch Polyisocyanurate Insulation
   3) Base Sheet
   4) Concrete Deck

f. Filter Gallery - Roof Area F-5
   1) Fully Adhered EPDM
   2) (1) Layer - 1.0 inch Phenolic Insulation
   3) Concrete Deck

g. Rapid Mix - Roof Area R-1
   1) Ballasted EPDM
   2) (1) Layer - 2.0 inch Polyisocyanurate Insulation
   3) Lightweight Concrete
   4) Concrete Deck

h. Penthouse - Roof Area P-1
   1) Ballasted EPDM
   2) (1) Layer - 1.5 inch Polyisocyanurate Insulation
   3) Coal Tar Pitch BUR System **(Assume Asbestos)**
   4) (2) Layers – 1.0 inch Wood Fiber Insulation
   5) Concrete Deck

i. Penthouse - Roof Areas P-2, P-3, P-4, P-5 and P-6
   1) Fully Adhered EPDM
   2) (1) Layer - 2.0 inch Polyisocyanurate Insulation
   3) Coal Tar Pitch BUR System **(Assume Asbestos)**
   4) (1) Layer - 0.5 inch Wood Fiber Insulation
   5) Metal Deck

j. Barton Pump Station - Roof Areas BP-1 and BP-2
   1) Ballasted EPDM
   2) (2) Layers - 1.5 inch Polyisocyanurate Insulation
   3) Coal Tar Pitch BUR System **(Assume Asbestos)**
   4) (2) Layers – 1.0 inch Wood Fiber Insulation
   5) Concrete Deck

k. Industrial Pumping Station - Roof Area IP-1
   1) Durolast PVC Membrane
   2) (1) Layer - 0.5 inch Fanfold Insulation
   3) Coal Tar Pitch BUR System **(Assume Asbestos)**
   4) Metal Deck

l. Liberty Pumping Station - Roof Area LP-1
   1) Durolast PVC Membrane
   2) (1) Layer - 0.5 inch Fanfold Insulation
   3) Coal Tar Pitch BUR System **(Assume Asbestos)**
   4) Metal Deck

m. North Campus - Roof Area NC-1
   1) Fully Adhered EPDM
   2) (1) Layer - 2.0 inch Polyisocyanurate Insulation
   3) (1) Layer – 1.0 inch Polystyrene Insulation
   4) Metal Deck

n. Superior Hydroelectric Building - Roof Area SH-1
   1) Fully Adhered EPDM
   2) (1) Layer – 0.5 inch Phenolic Insulation
   3) (2) Layers - 1.0 inch Polyisocyanurate Insulation
   4) Metal Deck

2. Laboratory Bulk Sample Analysis

a. In 2016, an Asbestos Survey was performed at the Water Treatment Plant buildings by Nova Environmental, Inc. Summaries of the asbestos inspection results, by building, are attached in Appendix B of the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 00 30 00

SECTION 01 11 13.1

SUMMARY FOR ROOFING

PART 1 - GENERAL REQUIREMENTS

1.01 DESCRIPTION OF WORK

A. The Work shall be completed at:

City of Ann Arbor Water Treatment Plant
919 Sunset Road
Ann Arbor, MI 48103

Outstations:

Barton Pumping Station
1010 Huron River Drive
Ann Arbor, MI 48103

Industrial Pumping Station
2000 S. Industrial Highway
Ann Arbor, MI 48104

Liberty Pumping Station
2675 W. Liberty Street
Ann Arbor, MI 48103

North Campus Pumping Station
1800 Beal Avenue
Ann Arbor, MI 48105

Superior Hydroelectric Pumping Station
6000 First Street
Superior Township, MI 48198

1.02 BASE SCOPE OF WORK

A. General: This Section is for the convenience of the Contractor only, and should not be construed as a complete accounting of all Work to be performed.

B. Provide all permits, staging / wall access, temporary protection, barricading, supervision, temporary facilities, warranties / guarantees, etc. as required to complete the work.

C. The extent of the Work is indicated on the Drawings and by the requirements in each Specification Section.

D. The Contractor shall be responsible for ensuring that process tanks, process water, interior finishes, carpeting, furnishings, merchandise and/or equipment in the building are adequately protected from debris, dust and water leaks throughout the duration of the project.

E. Coordinate the roofing work with the restoration work to ensure a proper and logical sequence to the repairs.

F. Demolition and Roof Preparation

1. Remove existing roof system and ballast, where present, down to the existing deck substrate as specified.
2. Protect all exposed roof tops, owner equipment, etc. from rain events.

G. Rough Carpentry

1. Provide new wood blocking where designated.
2. Replace rotted/deteriorated wood blocking.
3. Provide new area dividers/expansion joints where designated.

H. Mechanical/Electrical Work

1. Disconnect and reconnect units as required for lifting mechanical units.
2. Disconnect ductwork as required for lifting mechanical units to allow installation of the new roof system.
3. Coordinate installation of new roof penetrations with the Owner throughout the duration of the Project.

I. Vapor Retarder / Base Sheet

1. Provide new vapor retarder as per Plans and Specifications.

J. Roof Insulation

1. Provide new roof insulation components.
2. Provide new tapered roof insulation components.
3. Provide new coverboard on top of insulation components (at Water Treatment Plant Only).

K. Roof System/Flashings

1. Provide new single-ply membrane and associated flashings.

L. Roof-Related Sheet Metal

1. Provide new perimeter and field of roof sheet metal flashings where designated.

M. Plumbing

1. Furnish new clamping rings, domes and bolts for all existing drains.

N. Miscellaneous

1. Provide new walkways at designated locations as specified.
2. Provide non-penetrating platform at designated locations as specified.
3. Provide new non-penetration pipe supports at designated locations as specified.

O. Warranties

1. Provide a written five (5) year contractor's warranty against defective materials, defective workmanship, and water leakage. Warranty shall cover 100% replacement of the completed work as required to maintain the building exterior in a sound and weathertight condition.
2. Provide specified manufacturer warranties against defective materials, and against water leakage. Warranties/guarantees shall cover 100% replacement of the completed work as required to maintain the building exterior in a sound and weathertight condition during the warranty period. Reference Section 01 78 00 – Project Closeout and Warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 11 13.1

SECTION 01 11 13.2

SUMMARY FOR RESTORATION

PART 1 - GENERAL

1.01 LOCATION OF WORK

A. Work to be performed at:

City of Ann Arbor Water Treatment Plant
919 Sunset Road
Ann Arbor, MI 48103

Outstations:

Barton Pumping Station
1010 Huron River Drive
Ann Arbor, MI 48103

Industrial Pumping Station
2000 S. Industrial Highway
Ann Arbor, MI 48104

Liberty Pumping Station
2675 W. Liberty Street
Ann Arbor, MI 48103

North Campus Pumping Station
1800 Beal Avenue
Ann Arbor, MI 48105

Superior Hydroelectric Pumping Station
6000 First Street
Superior Township, MI 48198

1.02 WORK SUMMARY

A. This summary presents a general overview and should not be construed as a complete accounting of all work to be performed. The extent of the Work is indicated on the Drawings and by the requirements of each specification Section.

B. The Contractor shall be responsible for ensuring that process tanks, process water, interior finishes, carpeting, furnishings, merchandise and/or equipment in the building are adequately protected from debris, dust and water leaks throughout the duration of the project.

C. Furnish all labor, trades, equipment, materials, incidentals, and supervision to repair and provide a complete weathertight restoration of the exterior facility walls. A summary of the specified Work is presented in this Section.

D. Coordinate the restoration work with the roofing work to ensure a proper and logical sequence to the repairs.

E. Base Scope of Work

1. General
   a. Provide all permits, staging / wall access, temporary protection, barricading, supervision, temporary facilities, warranties / guarantees, etc. as required to complete the work.

2. Masonry Restoration
   a. Remove and replace existing distressed and deteriorated masonry. Reference Section 04900 – Masonry Repair and Restoration.
   b. Provide restoration and patching of limestone units. Work consists of repairing chipped/broken corners, and patching spalled/eroded/marred surfaces. Reference Section 04900 – Masonry Repair and Restoration.
   c. Cut and tuckpoint damaged and deteriorated mortar joints. Work includes saw-cutting existing joints, providing new pointing mortar, and removing any existing sealant over mortar joints that require tuckpointing. Reference Section 04 43 00 – Masonry Repair and Restoration.

3. Concrete Restoration
   a. Restore deteriorated concrete. Work includes removing unsound materials, preparing substrate surfaces, cleaning/priming exposed steel, and installing repair mortar with aggregate to match existing finishes. Restoration work also includes sealing existing cracks using a combination of techniques that include crack injection, routing/sealing with an elastomeric sealant. Reference Sections 03 93 00 – Concrete Patching and Restoration, and 07 92 00 – Joint Sealants for Restoration.

4. Steel
   a. Provide restoration and reconditioning of exposed/embedded steel components indicated on the Drawings. Work includes removing exterior brick courses, removing existing flashing materials where present, thoroughly cleaning exposed steel to remove rust chipped/failing paint, and reconditioning steel with primer and protective coating. Work also includes replacing and/or strengthening steel where required. Reference Sections 05 12 20 – Structural Steel for Restoration, and 09 96 00 – High Performance Coatings.

5. Sheet Metal Flashings
   a. Provide new sheet metal through-wall flashings in the existing exterior brick veneer at indicated locations. Work includes removing several courses of brick above the flashing location, reconditioning underlying support steel, installing new sheet metal flashings including a flexible sheet counterflashing, stepping through-wall flashing at roof transitions,. Reference Section 07 62 50 – Metal Flashing and Trim.

b. Provide metal flashing systems as indicated on the Drawings. Reference Section 07 62 50 – Metal Flashing and Trim.

6. Joint Sealants
   a. Remove all existing and provide new sealant at all exterior joints. Typical joints include; control/expansion joints, steel shelf angle/lintel joints, wall openings/penetrations, louvers, window/door perimeters, building material interfaces, inset masonry corners, wall-to-sheet metal roof flashings and building interfaces. Work includes saw-cutting masonry joints where required, removing existing sealant/backing materials, cleaning, and properly preparing joints prior to sealant application. Reference Section 07 92 00 – Joint Sealants for Restoration.
   b. Provide new sealant at head joints for limestone masonry, limestone sills, and limestone bands/ledges, to create a minimum 1/4 inch recessed weatherproofing seal. Work includes saw-cutting masonry joints where required, removing existing sealant/backing materials, tuckpointing damaged/unsound mortar, routing sound mortar to create a minimum 1/4 inch recess joint, cleaning joints & surfaces, and properly preparing joints prior to sealant application. Reference Sections 04 43 00 – Masonry Restoration and Cleaning, and 07 92 00 – Joint Sealants for Restoration.
   c. Remove all existing sealant, clean surfaces, and comprehensively seal all exterior glazing, metal-to-metal frame/flashing/ joints, and exposed fasteners at exterior window systems with sealant. Reference Section 07 92 00 – Joint Sealants for Restoration.

7. Cleaning
   a. Provide thorough restoration cleaning of all exterior masonry, concrete and limestone wall surfaces. Work includes implementing preparatory treatment of stained/discolored surfaces for effective cleaning procedures. Work also includes removal/cleaning of efflorescence, copper staining and tar stains. Reference Section 04 43 00 – Masonry Repair and Restoration.
   b. Upon completion of exterior masonry restoration, perform power wash cleaning of all exterior surfaces. Reference Section 04 43 00 Masonry Repair and Restoration.

8. Windows
   a. Remove and replace existing window systems. Reference Section 08 52 00 – Aluminum Windows.

9. Sealers/Coatings
   a. Provide a clear, water repellent sealer to exterior brick and/or limestone surfaces at indicated locations. Provide all necessary protection to non-masonry surfaces prior to sealer application. Reference Section 07 19 00 – Water Repellents.
   b. Provide a new elastomeric coating to concrete surfaces where designated. Work includes cleaning, properly preparing surfaces and applying elastomeric coating in accordance with the manufacturer's instructions. Reference Section 09 96 50 – Elastomeric Coatings.

10. Warranties

a. Provide a written five (5) year contractor's warranty against defective materials, defective workmanship, and water leakage. Warranty shall cover 100% replacement of the completed work as required to maintain the building exterior in a sound and weathertight condition.
b. Provide specified manufacturer warranties against defective materials, and against water leakage. Warranties/guarantees shall cover 100% replacement of the completed work as required to maintain the building exterior in a sound and weathertight condition during the warranty period. Reference Section 01 78 00 – Project Closeout and Warranties.

1.03 ALTERNATES

A. Window Replacement of remainder of windows at Filter Gallery Clerestory.

B. Window Replacement at Penthouse.

C. Window Replacement at Tower

D. Exterior Wall Restoration on Carbon House at South, East, and West Elevations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01102

SECTION 01 11 13.3

SUMMARY FOR INTERIOR RENOVATIONS

PART 1 - GENERAL REQUIREMENTS

1.01 DESCRIPTION OF WORK

The Work shall be completed at:

City of Ann Arbor Water Treatment Plant
919 Sunset Road
Ann Arbor, MI 48103

1.02 BASE SCOPE OF WORK

General: This Section is for the convenience of the Contractor only, and should not be construed as a complete accounting of all Work to be performed.

A. Provide all permits, staging / wall access, temporary protection, barricading, supervision, temporary facilities, warranties / guarantees, etc. as required to complete the work.

B. The extent of the Work is indicated on the Drawings and by the requirements in each Specification Section.

C. The Contractor shall be responsible for ensuring that process tanks, process water, interior finishes, carpeting, furnishings, merchandise and/or equipment in the building are adequately protected from debris, dust and water leaks throughout the duration of the project.

D. Coordinate the interior renovation work with roofing and restoration work to avoid conflicts and to ensure a proper and logical sequence.

E. Mechanical/Electrical/Plumbing Work
1. Disconnect and reconnect units as required for lifting, relocating and installation.
2. Coordinate installation of new equipment and appurtenances with the Owner throughout the duration of the Project.
3. Contractor shall utilize existing electrical and data connection locations to provide power and data for the new furniture in Reception/Clerk areas.
4. Coordinate installation, connection, and proper operation of television monitors with Owner information technology (IT) staff.

F. Demolition and Relocation
1. Remove, salvage and relocate items as specified on the Drawings, Specifications and as coordinated with the Owner.

2. Wall-mounted items to be salvaged, such as shelving, shall be removed and reinstalled after painting walls.
3. Coordinate with Owner and sequence demolition work as described in 02 41 00.

G. Time and Sequence
1. In general, it is the intention and understanding that the Contractor shall have control over the sequence or order of execution of the several parts of the Work to be done under the Contract, and over the method of accomplishing the required results. The Engineer may, however, make such reasonable requirements as may, in Engineer's judgement, be necessary for the proper and effective protection of Work partially or wholly completed, and to these requirements Contractor shall conform.
2. Contractor shall provide schedule and sequence of interior renovation work, as well as office, reception and clerk staff relocation efforts, for Owner approval. A phased approach to interior renovation work will be necessary to minimize disruption to administration and engineering staff. Contractor shall incorporate the following when developing schedule and sequencing plan:
   a. Only three (3) office will be available to the Contractor for work at a time.
   b. Contractor shall temporarily relocate up to three (3) offices at a time to the conference room. When work is complete in those offices, Contractor shall move the items of the temporarily relocated offices back prior to starting on the other three (3) offices.
3. Contractor shall coordinate relocation of office, reception and clerk staff with Owner. Owner will be responsible for packing up office/work area into boxes. Contractors shall be responsible for remaining relocation efforts including, but not limited to, transporting work stations, boxes, and furniture to be salvaged and reused.
4. Contractor shall provide Owner at least a 28-day notice prior to starting interior demolition work.

H. Warranties
1. Provide a written five (5) year contractor's warranty against defective materials and defective workmanship. Warranty shall cover 100% replacement of the completed work.

2. Provide specified manufacturer warranties against defective materials, and against water leakage. Warranties/guarantees shall cover 100% replacement of the completed work during the warranty period. Reference Section 01 78 00 – Project Closeout and Warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 11 13.3

SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Material allowances.

B. Contingency allowance.

1.02 CONTINGENCY ALLOWANCE

A. Include in the Contract the allowance sum as noted on Bid Forms for use upon Owner's instruction.

B. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.

1.03 ALLOWANCE ALLOCATION

A. Funds will be drawn from the Allowance by Change Order only.

B. At closeout of Contract, funds remaining in Allowance will be credited to Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 21 00

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for Alternates.

B. An Alternate Work Item is an amount proposed by bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in methods described in Contract Documents.

C. The Owner reserves the right to reject all Alternates or accept Alternates in any order or combination and to determine the low bidder for each classification of Work on the basis of the sum of the Base Bid and the Alternates accepted.

1.02 COORDINATION

A. The Contractor shall coordinate related Work and modify or adjust Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project.

1.03 NOTIFICATION

A. Immediately following the award of the Contract, the Contractor shall prepare and distribute to each party involved: (1) notification of the status of each Alternate; (2) indication of whether Alternates have been accepted, rejected or deferred for consideration at a later date; and (3) a complete description of negotiated modifications to Alternates.

1.04 SCHEDULE

A. "Schedule of Alternates" is included in the Bid Form and at the end of Section 01 11 13.2. Refer to individual specification sections for materials and methods necessary to achieve the Work described under each Alternate.

B. Include as part of each Alternate miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION – 01 23 00

SECTION 01 27 00

UNIT PRICES

PART 1 - GENERAL

1.01 PROJECT PRICING

A. Bidder shall complete the Bid Form within the front end documents, including all requested information.

1.02 UNIT PRICES

A. Bidders shall submit unit prices for each unit price item listed in the Bid Forms. The amount of each unit price shall be stipulated in the space provided in the Bid Form.

B. Unit prices shall be stated in the Contractor's proposal as to the amount to be added or deducted from the Base Bid as specified, including minor labor, material overhead, profit and taxes.

1.03 UNIT PRICE QUANTITY MEASUREMENT

A. The bidding contractors shall be solely responsible for the accuracy of all measurements and for estimating the material quantities required to satisfy these specifications.

B. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this Work measured by an independent surveyor acceptable to the Contractor at the Owner's expense.

C. Contractor shall maintain plan drawings, locating all unit price work performed. Location and size of repairs/corrections must be located on clean drawings. Separate drawings shall be maintained for each level and building. Contractor shall submit a copy of the drawings, identifying current quantities with each payment request. Work being invoiced must be properly identified. These drawings shall be incorporated into the contractor's "as builts" set required per Division 01.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 27 00

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 APPLICATION FOR PAYMENT

A. The form of Application for Payment shall be notarized AIA Document G702, "Application and Certification for Payment", supported by AIA Document G703, Continuation Sheet.

B. The form of Application for Payment shall be the Contractor's standard invoicing form. Invoicing, waivers of lien and similar attachments must be submitted to the Consultant for review and processing.

C. Submit four executed copies of each Application for Payment to the Consultant, including waivers of lien, certified payrolls, and similar attachments.

D. Progress Payments

1. Work being invoiced must be identified.
2. The Contractor shall submit Application for Payment to the Consultant for review and processing:
   a. For materials delivered to and stored on job site.
   b. Subsequent monthly payment requests.
3. Contractor shall maintain plan drawing locating Work performed; location and size of repairs must be located on a clean drawing. Contractor shall submit a copy of the drawings, identifying current quantities with each payment request.
4. Each Application for Payment shall be accompanied by a detailed estimate of the amounts and value of labor expended and materials purchased up to the last day of the preceding month, which shall not exceed 90 percent of the labor and material values estimated for the preceding month.
5. Such payments shall be viewed by both parties as progress payments and shall not, in any way, relieve the Contractor of performance obligations under this contract, nor shall such payments be viewed as approval or acceptance of Work performed under this contract.

E. Final Payment

1. Administrative actions and submittals that must precede or coincide with the final submittal for Application of Payment include the following:
   a. Final punch list report verifying compliance with provisions of the Contract Documents.
   b. Project record documents and field record drawings (as builts).
   c. Final Waiver of Lien executed by each supplier and subcontractor.
   d. Consent of Surety for Final Payment.
   e. Other.

2. Warranties/guarantees shall commence upon the date of final punch list verification as found on the Construction Review Punch List.
3. Application for Payment shall reflect adjustments and previous progress payments.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00

PROJECT MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. The Consultant will conduct project meetings throughout the construction period to enable review during progress of the Work, and to provide for systematic discussion of problems.

1.02 REPRESENTATION

A. Each Contractor and major subcontractor shall be represented at every meeting by a responsible member of their organization.

1.03 SUBMITTALS

A. The proceedings of these meetings will be recorded by the Consultant, and each required representative at meetings will be furnished one copy in addition to the Owner.

B. The Consultant will conduct meetings, record notes, and distribute meeting minutes on behalf of the Owner. This, however, shall not be construed as coordinating or scheduling Contractor's Work.

1.04 DECISIONS/INTERPRETATIONS

A. All decisions and interpretations given by the Consultant at project meetings, upon confirmation by the Owner, shall be final on each Contractor affected.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 MEETING SCHEDULE/DATE AND TIME/LOCATION

A. Meeting shall be conducted at a minimum once per month; and more frequently as the work necessitates.

B. Meeting schedule will be as agreed to by the Owner and Contractors at preconstruction meeting.

C. If a change in meeting date/time is required due to causes beyond control of the Owner, all concerned parties will be advised in advance of such change.

D. To the maximum extent practical, meetings will be held at the job site.

3.02 PRECONSTRUCTION MEETING

A. Meeting will be scheduled within fourteen (14) days after a Notice to Proceed has been issued. The Owner will advise other interested parties and request their attendance. Contractor shall advise major subcontractors to be present.

B. Minimum Agenda

1. Organizational arrangement of Contractor's forces and personnel and those of subcontractors, materials suppliers, and the Owner.
2. Channels and procedures for communications.
3. Construction schedule, including sequence of critical Work.
4. Contract Documents, including distribution of required copies of original documents and revisions.
5. Processing of shop drawings and other data submitted to the Consultant for review.
6. Rules and regulations governing performance of the Work.
7. Procedures for safety and first aid, security, quality control, housekeeping, and other related matters.
8. Scheduling of project meetings.
9. Project record documents (as-builts).
10. Shop drawings.
11. Protection of Process Water and Process Tanks.
12. Site Security
13. Work Hours (7am to 7pm M-F, no weekends, no holidays)
14. Contractor's Coordination and Sequencing of the Roofing and Masonry Work.
15. Safety and Signage.

3.03 PROJECT MEETINGS

A. Attendance

1. To the maximum extent practical, the Contractor and major subcontractors shall assign the same person or persons to be present as representatives at project meetings throughout progress of the Work. Subcontractors, material suppliers, and others may be invited to attend those project meetings in which their aspects of the Work are involved.

B. Minimum Agenda

1. Safety Issues.

2. Review, revise as necessary, and approve minutes of previous meeting.
3. Review progress of the Work since last meeting, including status of submittals for approval.
4. Identify concerns and review quality control/assurances of Work in progress and Work completed.
5. Identify problems which may impede planned progress.
6. Processing of field decisions and change orders.
7. Develop corrective measures and procedures to maintain/regain planned schedule.
8. Complete other current business.

END OF SECTION 01 31 00

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SCHEDULE

A. Prior to the Preconstruction Meeting the Contractor shall prepare an estimated progress schedule and submit it to the Consultant for review.

B. Contractor shall provide a separate schedule form for each major subcontractor.

1.02 ADMINISTRATIVE PROCEDURES

A. Contractor shall submit to the Consultant the required product submittals as specified in each product section.

B. Where the phrase, "or equal" or "or equal as approved by the Owner" occurs in the Contract Documents, Contractor shall not assume materials, equipment, or methods will be approved as equal unless the item has been approved for this work by the Consultant and the Owner.

C. Contractor shall not substitute materials, equipment, or methods unless such substitution has been approved for this work by the Consultant and the Owner. The decision of the Owner shall be final.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. Review shop drawings, project data and samples and affix Contractor's stamp prior to submission to the Consultant.

B. Verify:

1. Field dimensions.
2. Catalog numbers, quantities and similar data.

C. Contractor's responsibility for errors and omissions in submittals is not relieved by Consultant's review of submittals.

D. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Consultant's review of submittals, unless Consultant gives written acceptance of specific deviations.

E. Contractor shall notify Consultant in writing at the time of submission of deviations in submittals from requirements of Contract Documents.

1.04 SUBMISSION REQUIREMENTS

A. The number of copies to be submitted will be determined at the pre-construction conference. Reproducibles may be submitted and will be marked and returned to Contractor. Blue or black line prints shall be submitted in sufficient quantity for distribution to Engineer and Owner recipients.

B. Bid submittals are submittals that shall be provided by the Contractor prior to Owner acceptance of Bid and shall include:

1. Certificates of insurance and insurance policies.

C. Pre-construction submittals are submittals that shall be provided by the Contractor to the Consultant for review and approval prior to the pre-construction meeting. These items shall include, but are not limited to:

1. List of subcontractors.
2. List of principal suppliers and fabricators.
3. Schedule of values.
4. Contractor's construction schedule (preliminary, if not final).
5. Schedule of principal products, along with material information.
6. Manufacturer warranties and Contractor guarantees (including dollar values coverage).
7. Submittal schedule (preliminary, if not final).
8. List of Contractor's staff assignments.
9. List of Contractor's principal consultants.
10. Copies of applicable permits.
11. Copies of authorizations and licenses from governing authorities for performance of the Work.
12. Initial progress report.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.

D. Each submittal is to contain the following criteria:

1. Field dimensions, clearly defined as such.
2. Specification section number and Article that submittal pertains to.
3. Applicable standards such as ASTM number or Federal specification.
4. A blank space, 3" x 4", for the Consultant's stamp at the lower right-hand corner of drawings, when possible.
5. Identification of deviations from the Contract Documents.
6. Contractor's stamp, initialed or signed, certifying review of submittal, verification of field measurements and compliance with the Contract Documents.
7. Use separate transmittals for items from different specification sections. Number each submittal consecutively beginning with the specification section. Resubmittals should have the same number as the original, plus a letter designation for each resubmittal (i.e., 01330-1-A, 01330-1-B, etc.).

E. The submission of submittals and samples to the Consultant that have been approved by the Contractor and the review of said submittals and samples by the Consultant shall not constitute submission in writing or approval in writing of any deviation from the requirements of the Contract Documents unless it is brought to the attention of the Consultant that specific changes are being suggested.

F. Changes to the drawings and specifications by means of submittals become the responsibility of the party initiating such changes.

G. No delay or omission to exercise any right or remedy accruing to the Consultant upon any breach or event of default of the Contractor shall impair any such right or remedy or be construed to be a waiver of any such breach or default; nor be deemed a waiver of any other, prior, or subsequent breach or default. Any waiver, permit, consent, or approval on the part of Consultant of any breach or default, or of any provision or condition hereof, must be in writing and shall be effective only to the extent that such writing specifically sets forth.

H. Certificates:

1. Any certificate for demonstrating proof of compliance of materials with the requirements of the Contract Documents shall be executed in three copies.
2. Each certificate shall be signed by an authorized officer of the manufacturing company and shall contain:
   a. Name and address of the Contractor
   b. Project name
   c. Location
   d. Quantity and dates of the tests to which the report applies

3. Certification shall not be construed as relieving Contractor from furnishing satisfactory material. If, after tests are performed on selected samples, the material is found not to meet the specific requirements, the entire order may be rejected.

I. Consultant’s Submittal Stamp

1. The Consultant's terminology on the submittal review stamp of "NO EXCEPTION TAKEN" shall mean that the Consultant has reviewed and confirmed the submittal so stamped only for conformance with the design concept of the Project as given in the Contract Documents.
2. The Consultant's terminology on the submittal review stamp of "MAKE CORRECTIONS NOTED" shall mean that the Consultant has reviewed the submittal so stamped, subject to the corrections made on the submittal, only for conformance with the design concept of the Project as given in the Contract Documents. Revision and re-submittal is not required.
3. The Consultant’s terminology on the submittal review stamp of “RECEIVED” shall mean that the Consultant acknowledges receipt of the informational submittal (such as MSDS Sheets), but has not performed a formal review for conformance to any requirements or regulations.

4. The Consultant's terminology on the submittal review stamp of "REJECTED" shall mean that the Consultant has reviewed the submittal so stamped only for conformance with the design concept of the Project as given in the Contract Documents, but the submittal does not meet the specified requirements and shall not be included as part of the Project.
5. The Consultant's terminology on the submittal review stamp of "REVISE AND RESUBMIT" shall mean that the Consultant has reviewed the submittal so stamped, subject to the corrections made on the submittals, for conformance with the design concept of the Project as given in the Contract Documents. The Contractor shall make the noted corrections and re-submit to the Consultant.
6. The Consultant's stamp on the submittal shall not imply approval of quantities, dimensions, fabrication processes and techniques of construction, all of which shall remain the responsibility of the Contractor.
7. The Consultant's stamp on a submittal shall not relieve the Contractor from responsibility for errors or omissions in the submittal and shall not imply that the Contractor may proceed in error.

1.05 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

A. Consultant will distribute reviewed copies of shop drawings and project data which carry Consultant's stamp to:

1. Contractor's file
2. Owner
3. Record documents file (Consultant)

B. Contractor will distribute copies of shop drawings and project data which carry Consultant's stamp to:

1. Job site file
2. Subcontractors (as required)
3. Supplier (as required)
4. Fabricator (as required)

1.06 CONSULTANT'S DUTIES

A. Review submittals and transmit to Contractor within 10 working days after receipt of submittals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 00

SECTION 01 43 00

QUALITY ASSURANCE

PART 1 - GENERAL

1.01 GENERAL

A. Contractor shall provide a minimum of 48 hours notice of required site reviews to the Consultant to allow scheduling. Unless critical, such reviews shall be scheduled when sufficient areas are prepared to effectively utilize the Consultant's visit.

B. Contractor shall keep on site at all times the following items:

1. The most recent revision of the Contract Documents, including all changes made by addenda, sketches, bulletins, change orders and approved submittals.
2. Material safety and data sheets

1.02 DAILY CALL-INS/FIELD QUALITY ASSURANCE LINE

A. Contractor must report in daily all anticipated work activities.

B. “Call-ins” must be made in the morning of anticipated work, prior to 7:30 am (local time).

C. Message must be left on the the Field Quality Control Line, number 1-800-745-7832 Ext. 3000.

D. The required project information is as follows:

1. Contractor's Company Name
2. Client & Project Site/Location
3. StructureTec Project #
4. Anticipated work activities for the day
5. If not working, indicate reason why

E. Failure to comply with these procedures may result in a “project shutdown” and/or retainage of payment schedule until compliance is satisfied.

1.03 OWNER, CONSULTANT, AND CONTRACTOR

A. Owner's Representative on Site: The Consultant acts on behalf of the Owner to verify that the Work is completed in accordance with the Contract Documents, and is entitled to conduct reviews of the Contractor's Work and materials and to perform or witness such tests as are specified or directed. In order to avoid conflict of operations or delay in completion of the Work, the Consultant may furnish the Contractor with non-binding recommendations pertaining to the methods, sequencing and priority of the operations or Work, without taking responsibility for the execution or results thereof. Only those modifications of adjustments in the Work that are stipulated by a duly executed change order, change directive, bulletin, or other form of written authorization by the Consultant will be formally recognized and legally binding.

B. Communication to Owner: All communication from the Contractor to the Owner on Contract matters shall be through the Consultant, except as otherwise specified in writing.

C. Instructions to Contractor: The Owner will issue all instructions to the Contractor through the Consultant, except as otherwise specified in writing.

D. Consultant/Contractor Relationship: The Consultant is the Contractor's single point of contact for all submittals and approvals (shop drawings, samples, tests and the like), interpretation of the Contract Documents and changes, and claims of whatever nature. The Consultant will inform the Contractor of all decisions on questions which may arise with respect to specifications, plans, the Contract.

1.04 TESTING AND INSPECTION SERVICES

A. The Contractor, shall be responsible for providing, paying for, coordinating and scheduling the services of an independent testing firm (acceptable to the owner) to perform all material testing, inspection services, and related tasks.

B. The independent firm will perform tests, inspections and other services, specified in individual specification sections and as required by the Engineer.

C. Acceptable testing companies for selection by the Contractor (excluding paint testing) are:

1. CTI (Wixom, Michigan; Telephone: (248) 486-5100)
2. SME (Plymouth, Michigan; Telephone (734) 454-9900)
3. PSI (Plymouth, Michigan; Telephone (734) 453-7900)
4. TEC (Ann Arbor, Michigan; Telephone: (734) 623-0400)

D. Acceptable testing companies for selection by the Contractor for painting are:

1. Dixon Engineering (Lake Odessa, Michigan; Telephone: (616) 374-3221)
2. Nelson Tank (Lansing, Michigan; (517) 321-1692)

E. Testing, inspections and source quality control may occur on or off the project site. Perform off-site testing as required by the Engineer or the Owner.

F. Reports will be submitted by the independent firm to the Engineer and the Contractor, in duplicate, indicating observations and results of tests and indicating compliance or noncompliance with the Contract Documents.

1. Notify the Engineer and independent firm a minimum of 24 hours prior to expected time for operations requiring services.
2. Make arrangements with the independent firm and pay for additional samples and tests required for the Contractor's use.

G. Independent testing firm will provide the testing services listed below. Any additional services required by the Contract Documents beyond what is listed, shall be provided by the Contractor.

1. Concrete
    a. A concrete test shall be performed on each truck bringing materials to the site.

2. Grout and Mortar
    a. Comprehensive strength. Four (4) cylinders each with laboratory testing.
    b. Prism tests. Conduct one test for each type of wall construction indicated.

3. Painted Surfaces
    a. Verify coatings and other materials are as specified.
    b. Verify surface preparation and applications are as specified.
    c. Visually inspect all welds prior to coating.
    d. Verify DFT of each coat and total DFT of each coating systems are as specified using wet film and dry film gauges.
    e. Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.

H. Contractor shall not perform the work without the independent firm on site performing the required tests.

I. Testing and employment of testing agency or laboratory shall not relieve the Contractor of obligation to perform work in accordance with requirements of the Contract Documents.

J. The independent firm on instructions by the Engineer shall perform re-testing or re-inspection required because of non-conformance of specified requirements. Payment for re-testing or re-inspection will be the responsibility of the Contractor.

K. Agency Responsibilities:

1. Test samples of mixes submitted by the Contractor.
2. Provide qualified personnel at site. Cooperate with the Engineer and the Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of the Contract Documents.
5. Promptly notify the Engineer and the Contractor of observes irregularities or nonconformance of work or products.

6. Perform additional tests required by the Engineer.

L. Agency Reports: After each test, promptly submit two copies of report to the Engineer and the Contractor. When requested by the Engineer, provide interpretation of test results. Include the following:

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 the Contract Documents.

M. Limits On Testing Authority

1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of the Contract Documents.
2. Agency or laboratory may not approve or accept any portion of the Work.
3. Agency or laboratory may not assume any duties of the Contractor.
4. Agency or laboratory has no authority to stop the Work.

1.05 ACCESS TO THE SITE

A. The Owner, Consultant and their authorized representatives shall have access to the site and to the Work. The Contractor shall facilitate and provide assistance for access by such persons.

1.06 CONSULTANT SITE REVIEWS

A. Materials:

1. A site review will be conducted by the Consultant prior to commencement of any Work to substantiate that all materials conform to the specifications and approved submittal data. Unfit materials will be rejected and conspicuously marked. These materials shall be removed from the job site by the Contractor, who, in turn, shall replace them with acceptable materials in a timely manner and shall not delay the progress of the job.
2. No Work may commence until an acceptable amount of approved materials is at the job site and reviewed by the Consultant.
3. Any indication of an unauthorized substitution of materials will be considered a justifiable cause for rejecting the entire portion of Work relating to said materials.

B. Workmanship:

1. Workmanship will be reviewed by the Consultant to the extent necessary to determine that the Work conforms to the Contract Documents.

2. All reviews by the Consultant will be performed in such manner as not to delay the Work unnecessarily; however, neither the Owner nor the Consultant shall be liable for such delays.
3. Contractor shall, without charge, correct any workmanship found by the Consultant not conforming to the Contract requirements.
4. If Contractor does not promptly correct rejected workmanship, the Owner may: (1), by Contract or otherwise, correct such workmanship and charge the cost thereof to the Contractor or (2) terminate Contractor's right to continue the Work in accordance with Article 14, Paragraph 14.2 of the "General Conditions of the Contract for Construction".

1.07 PROJECT MANAGEMENT, PROGRESS AND FINAL CONSULTANT REVIEWS

A. Consultant will be on site performing construction review on a consistent basis throughout the course of the project.

B. Construction review by the Consultant will be required at the final completion, and remaining "punch list" items will be determined and designated.

C. While Work is still in progress, it is the Contractor's responsibility to notify Consultant prior to leaving the job site so that the "punch list" can be implemented and executed on a timely basis.

D. These procedures will not negate or supersede periodic progress reviews as performed by the designated representatives and/or employees of Consultant.

E. In addition, further construction review may be implemented by the Owner, or Owner's Representative, on a discretionary basis, as well as performing a final *StructureScan*™ survey at the project close-out to ensure proper construction and integrity. This contract Work will be handled under separate cover and separate provisions will be made for these additional services by the building Owner and/or Owner's Representative.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 43 00

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 GENERAL

A. Utilities: All temporary facilities shall be subject to the Owner's approval.

1.02 PROJECT STAGING

A. Staging for the Work shall be an Owner-approved location as designated.

1.03 TEMPORARY ELECTRIC

A. Electrical service may be available at no charge to the Contractor from existing electrical sources. Contractor may obtain temporary power for construction from this source or may use their own generator. Temporary power service shall comply with OSHA standards. The Contractor shall maintain these temporary services in good order throughout the Project until repair Work is complete. All extension cords shall be provided by the contractor or subcontractor requiring the power. All required electrical equipment shall be GFIC protected.

1.04 TEMPORARY WATER

A. Owner may provide for water used for on-site construction purposes. The Contractor shall provide and maintain necessary temporary connections to the source of temporary supply, including necessary safety devices, controls and backflow valves.

B. Provide potable drinking water for construction personnel at all times.

1.05 TEMPORARY SANITARY FACILITIES

A. Contractor shall provide, pay for and maintain sufficient and approved sanitary facilities with weatherproof enclosures. These facilities shall be clean and sanitary at all times, and shall be satisfactory to the local board of health and the Owner.

B. Location shall be approved by the Owner.

1.06 TEMPORARY PARKING

A. Contractor's employee parking, delivery trucks, and other construction vehicle parking shall only be at areas designated by the Owner.

1.07 TEMPORARY FIRE PROTECTION

A. Contractor shall provide adequate fire protection and fire prevention for the Project, and in no case less than that required by applicable city, county, state, and federal regulations.

1.08 FIRST AID

A. Contractor shall provide a first aid kit with adequate provisions for the materials being used on site.

B. Contractor shall maintain an envelope to hang above the first aid kit which will contain all of the material safety data sheets for materials being used on this Project.

1.09 SECURITY

A. Contractor shall be responsible for the security of their work area and equipment.

B. Contractor staff to provide copy of driver's license.

C. Staff to wear company badges.

1.10 DUST AND FUME CONTROL

A. Contractor shall take all necessary precautions to keep dust confined in the present work area.

1. Work will be immediately shut down if any dust or debris is entering process water.
2. Contractor will be responsible for all fines associated with non-compliance and violations.

B. Contractor shall be responsible for any damage to vehicles due to the construction.

C. Contractor shall submit to the Owner, for approval, proposed methods used to contain dust, fumes, and debris in work area.

1.11 ENCLOSURES

A. Contractor shall furnish, install, and maintain for the duration of construction all required scaffolds, tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms, and other temporary construction necessary for proper completion of the Work in compliance with all safety and other regulations.

1.12 FENCING OF THE CONSTRUCTION AREA

A. Contractor shall furnish and install temporary fencing compliant with local ordinances and per Owner's requirements around all ground-located equipment and materials.

B. The use of a kettle for heating the specified bitumen is acceptable, provided the Contractor locks all lids and spigots at the end of the day.

1.13 PROTECTION OF CONCRETE SIDEWALKS AND ASPHALT PARKING LOTS

A. Protect all concrete sidewalks and asphalt parking lots at staging locations and areas surrounding the building. Damaged areas shall be replaced or repaired at the Contractor's expense.

1.14 HEATING

A. Contractor shall provide and maintain all heat needed for proper conduct of all operations included in the Work.

1.15 TELEPHONE/PAGER SERVICE

A. Contractor shall be responsible to provide telephone service or other acceptable methods of communication services at the Project site.

1.16 BARRIERS (INTERIOR RENOVATION WORK)

A. In general, provide barriers between active construction operations and completed areas of work, and between construction activity and Owner-occupied areas. Provide barriers in locations indicated on drawings, or if not indicated, as required by Owner's Representative.

1. Construct dust barriers of metal or fire-retardant treated wood studs and 6 mil thick plastic sheet.
2. Construct construction barriers serving as separation between active construction areas and occupied areas to provide 1-hour fire-rated assembly as defined by Underwriters Laboratory "Fire-Resistance Directory."
3. Provide dust covers over Owner's equipment and furnishings. Use 6 mil thick clear plastic sheet and thoroughly tape seams to provide dust-proof cover.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 50 00

SECTION 01 63 00

PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 GENERAL

A. Whenever the proposal of substitute material, equipment or process is permitted by the specifications, the proposed substitute material, equipment or process shall be submitted in accordance with the General Conditions and subject to requirements of this Section.

B. Voluntary substitutions by the bidder will not be considered.

1.02 REQUIREMENTS

A. Consultant shall review the acceptability of the proposed substitute.

B. The proposal of substitute material, equipment or process will be considered only for one of the following reasons:

1. The manufacture or production of the specified material, equipment, or process has been discontinued.
2. The specified material, equipment, or process is not available in sufficient quantity or quantities to complete the Work. Failure of the Contractor to award subcontracts in sufficient time or failure of the Contractor and/or the Subcontractor involved to place orders for material, equipment or process so as to insure delivery or execution without delaying the Work shall not establish cause for approval of substitutions.
3. Delays beyond the control of the Contractor such as, but not limited to, strikes, lockouts, storms, fires or earthquakes, preclude the procurement and delivery of material or equipment for the Project as included in Contractor's proposal.
4. Availability or an earlier delivery date for proposed substitute will advance the overall progress of the Work.
5. There will be an improvement in quality or function of the material, equipment or process.

C. If the Contractor proposes a substitute to the Project, the Contractor must submit a separate request for each product, supported by complete data with drawings and samples as appropriate, including:

1. Comparison of the qualities of the proposed substitution with that specified.
2. Changes required in other elements of the Work because of substitution.
3. Effect on the construction schedule.
4. Cost data comparing the proposed substitution with the product specified.
5. Any required license fees or royalties.

6. Availability of maintenance service and source of replacement materials.

D. Any proposed substitute material, equipment or process shall be subject to the following conditions:

1. Submittal of the proposed substitute material, equipment or process per the General Conditions.
2. Submittal of the request for a substitution early enough to allow ample lead time for the Consultant's review, preparation of the submittals, fabrication and delivery, without delaying the Work.
3. Approval of substitutions by the Consultant and the Owner in the form of a duly executed change order, change directive, bulletin or other form of written authorization.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 63 00

SECTION 01 66 00

PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.01 TRANSPORTATION AND HANDLING

A. Contractor shall arrange deliveries of products in accordance with construction schedules and coordinate to avoid conflict with the Work and conditions at the site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
2. Upon delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals and that products are protected and undamaged.

1.02 STORAGE AND PROTECTION

A. Contractor shall arrange storage in a manner to provide easy access for inspection and make periodic inspections of stored products to assure that products are maintained under specified conditions and free from damage or deterioration.

B. Contractor shall store products in accordance with manufacturer's instructions and as required by the Contract Documents, with seals and labels intact and legible.

1. Store products subject to damage by the elements in weathertight enclosures.
2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

C. Where exterior storage is utilized, Contractor shall:

1. Store fabricated products above the ground on blocking skids.
2. Cover products with impervious sheet coverings and provide adequate ventilation to avoid condensation.

D. Protection after installation

1. Provide coverings to protect installed products from damage from weather, traffic and subsequent construction operations.
2. Remove products when no longer needed.

PART 2 - MATERIALS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 66 00

SECTION 01 78 00

PROJECT CLOSEOUT AND WARRANTIES

PART 1 - GENERAL

1.01 COMPLETION

A. Project Close Out

1. Throughout the progress of the Work, the Contractor shall keep a current, detailed record of changes in the installation of his own work from the conditions, locations, and layout shown on the accompanying drawings or manufacturer details. This information shall be submitted to the Consultant. This requirement does not authorize any deviations without the approval of the Owner or Owner's Representative.
2. When all revisions showing Work as finally installed are made, the field record drawings (as-builts) shall be delivered to the Owner before final payment is made. As-built set to be clean, neat and legible.
3. Submit the following before final payment is made:
   a. Project record documents
   b. Guarantees and warranties in a separate 3-ring binder (2 copies).
   c. Applicable waivers of lien
   d. Invoice(s) reflecting adjustments and previous progress payments
   e. Consent of Surety to Final Payment
   f. Signed punch list

1.02 CLEANING AND CLOSEOUT

A. Each contractor or subcontractor, in addition to the responsibilities set forth in the General Conditions, shall keep the premises free from accumulation of waste materials or rubbish caused by their employees or Work.

B. At the completion of the Project, the Contractor shall restore or replace all property damaged by their Work and remove spots, paint, soil, concrete, writing, droppings, or other foreign material from Work. Remove temporary protection from the Work.

C. All rutting shall be restored and disturbance to lawn areas shall be seeded/mulched.

D. Consultant will issue a punch list, along with a drawing, showing locations of the unacceptable Work items to the Contractor after Substantial Completion of the Project.

E. Contractor shall be responsible for maintaining work areas in a neat and orderly manner. Upon completion, cleanup shall be performed to the satisfaction of the Owner or Owner's Representative. Contractor shall be responsible for the return of site-exposed surfaces to their original condition prior to the start of the Work.

F. Contractor shall complete all necessary cleanup within 10 working days after receiving notification of cleanup requirements as outlined in the punch list.

1.03 WARRANTIES

A. Base Bid Warranty

1. The roof system, as specified and completed under this specification, shall be covered under a manufacturer's NDL warranty for a period of 20 years.
2. Sheet metal, as specified and installed under this specification, shall have a manufacturer's finish warranty for a period of twenty (20) years.
3. Urethane sealants, as specified and installed under this specification, shall be covered under a manufacturer's warranty for a period of ten (10) years against defective materials.
4. Silicone sealants, as specified and installed under this specification, shall be covered under a manufacturer's warranty for a period of twenty (20) years against defective materials.

1.04 GUARANTEES

A. Work, as specified and completed under this specification, shall be covered under a separate contractor's guarantee for a period of 5 years.

B. Drain and piping installations shall be covered under a contractor's guarantee for a period of two (2) years, maintaining all plumbing included in the Work in a watertight condition without cost to the Owner.

C. Warranties and guarantees shall commence upon the date of final punch list verification as found on the Final Construction Review Punch List.

D. Warranties and guarantees are to be furnished by the Contractor and submitted to the Consultant for review at the time of final payment.

1.05 GUARANTEE/ROOFING (ROOF REPAIR PROJECTS)

A. Work as specified and completed under this specification shall be covered under the National Roofing Contractors Association (NRCA) guarantee for a period of two (2) years.

1. Guarantees are to be furnished by the Contractor and submitted to the Consultant for review at the time of final payment.

B. Warranty Enforcement: Defects in materials or workmanship, which are discovered and made known to the Contractor during the warranty period, shall be repaired or replaced and/or adjustments shall be made without delay upon written notification from the Owner and at no additional cost to the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 00

SECTION 01 80 00 – CERTIFIED PAYROLL COMPLIANCE AND REPORTING

PART 1 - GENERAL

1.01 SUMMARY

This specification covers all administrative requirements, payroll reporting procedures to be followed by Contractors performing work on City-sponsored public improvements projects, and all other miscellaneous and incidental costs associated with complying with the applicable sections of the City of Ann Arbor Code of Ordinances with regard to payment of prevailing wages and its Prevailing Wage Compliance policy.

This specification is **not** intended to include the actual labor costs associated with the payment of prevailing wages as required. Those costs should be properly incorporated in all other items of work bid.

1.02 GENERAL

The Contractor is expected to comply with all applicable sections of Federal and State prevailing wage laws, duly promulgated regulations, the City of Ann Arbor Code of Ordinances, and its Prevailing Wage Compliance Policy as defined within the contract documents. The Contractor shall provide the required certified payrolls, city-required declarations, and reports requested elsewhere in the contract documents within the timeline(s) stipulated therein.

The Contractor shall also provide corrected copies of any submitted documents that are found to contain errors, omissions, inconsistencies, or other defects that render the report invalid. The corrected copies shall be provided when requested by the Supervising Professional.

The Contractor shall also attend any required meetings as needed to fully discuss and ensure compliance with the contract requirements regarding prevailing wage compliance. The Contractor shall require all employees engaged in on-site work to participate in, provide the requested information to the extent practicable, and cooperate in the interview process. The City of Ann Arbor will provided the needed language interpreters in order to perform wage rate interviews or other field investigations as needed.

Certified Payrolls may be submitted on City-provided forms or forms used by the Contractor, as long as the Contractor's forms contain all required payroll information. If the Contractor elects to provide their own forms, the forms shall be approved by the Supervising Professional prior to the beginning of on-site work.

1.03 UNBALANCED BIDDING

The City of Ann Arbor will examine the submitted cost for this item of work prior to contract award. If the City determines, in its sole discretion, that the costs bid by the Contractor for complying with the contract requirements are not reasonable, accurately reported, or may contain discrepancies, the City reserves the right to request additional documentation that fully supports and justifies the price as bid. Should the submitted information not be determined to

be reasonable or justify the costs, the City reserves the right to pursue award of the contract to the second low bidder without penalty or prejudice to any other remedies that it may have or may elect to exercise with respect to the original low-bidder.

The Contract Completion date will not be extended as a result of the City's investigation of the as-bid amount for this item of work, even if the anticipated contract award date must be adjusted. The only exception will be if the Contractor adequately demonstrates that their costs were appropriate and justifiable. If so, the City will adjust the contract completion date by the number of calendar days commensurate with the length of the investigation, if the published Notice to Proceed date of the work cannot be met. The contract unit prices for all other items of work will not be adjusted regardless of an adjustment of the contract completion date being made.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 01 80 00

DETAILED SPECIFICATIONS

ARCHITECTURAL AND STRUCTURAL REPAIRS

SECTION 02 22 00

SELECTIVE DEMOLITION FOR ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish all labor, materials, equipment and supervision to demolish, haul and dispose of items in accordance with the Contract Documents.

1.02 REFERENCES

A. American National Standards Institute (ANSI): Safety Requirements for Demolition, Document A10.6.

B. Occupational Safety and Health Administration (OSHA): Construction Safety Act, Part 1926.

1.03 PERFORMANCE REQUIREMENTS

A. Contractor shall be responsible for the planning and implementation of the demolition work including the safety of persons and property. This responsibility shall not transfer to the Owner, governing authorities or Consultant.

B. The building space directly under the roof area covered by this specification will be utilized for concurrent and ongoing operations. These operations shall not be interrupted by the Work in process.

C. Contractor shall examine areas and conditions under which the Work is to occur and notify the Consultant in writing as required in the General Conditions of any conditions detrimental to the proper and timely completion of this Work.

D. Consultant's review shall be conducted to verify general conformance with the requirements of the Contract Documents.

E. Contractor shall take adequate precautions to prevent unauthorized personnel from entering the job site.

F. Contractor shall conduct demolition operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities and shall not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.

G. Contractor shall maintain adjoining properties, public thoroughfares, sidewalks, and utilities to prevent damage that may be caused by the Work.

H. At no cost to the Owner, Contractor shall repair damage to adjacent facilities resulting from demolition operations.

I. Contractor shall provide necessary protection to prevent airborne construction material, debris, dust, fumes, etc. from entering process water, process tanks, occupied spaces (e.g. adjacent building, air intake).

1.04 SUBMITTALS

A. Furnish Owner and Consultant with a detailed plan to ensure that Work will be accomplished in a safe and prudent manner.

B. Submit demolition procedures, operations sequence, permits and notices authorizing demolition, certificates of severance of utility services, if required, method of traffic maintenance, permit for transport and disposal of debris, and location of disposal area.

1. Access for owner's operations and chemical deliveries shall be maintained at all times.

C. Contractor shall review with the Owner and Consultant the types of equipment proposed for use during the course of the project.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Pre-Construction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 – Project Meetings. The items of discussion may include, but are not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review and finalize demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review requirements of work performed by other trades that rely on substrates exposed by demolition operations.
4. Review and finalize protection requirements.

1.06 PROJECT CONDITIONS

A. Maintain access to existing walkways, exits, corridors and other adjacent occupied or used facilities. Do not close or obstruct walkways, exits, corridors, or other occupied facilities without written permission from authorities having jurisdiction.

B. Hazardous Materials: Hazardous materials are not expected to be encountered in Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the Owner and Consultant.
2. Hazardous materials will be removed by the Contractor using an allowance specified in the Bid Form.

C. Storage of hazardous materials on-site will not be permitted.

D. Asbestos Containing Materials (ACM):

1. All products of demolition containing asbestos shall be removed and properly disposed of in conformance to EPA requirements, as well as any local, state, and federal regulations relating to these materials.
2. Contractor to complete a Manifest Form for ACM to be removed and dumped. The hauler and dump site must both be state approved. The Manifest Form must be filled out with each load of material that is hauled and dumped.
3. Dumpsters shall be double lined in accordance to local, state, and federal regulations. Materials shall be disposed of in an approved Type II landfill. Documentation will be required to confirm proper disposal.

E. Utility Service: Maintain existing utilities in service and protect them against damage during selective demolition operations.

F. Fire Protection: Maintain fire-protection services during selective demolition operations.

1.07 SEQUENCING & SCHEDULING

A. Scheduling of the work shall be coordinated with the Owner. Contractor shall be prepared to modify or revise the plan as necessary to accommodate the Owner's requirements. The schedule shall include the number of days that are required for each area of work, coordination and sequencing between demolition and replacement, as well as disposal of materials.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 DEMOLITION

A. General

1. All products and debris resulting from demolition, shall become the responsibility of the Contractor and shall be removed from the Owner's property.
2. Disposal of these materials, including transportation thereof, shall become the responsibility of the Contractor, who shall abide by all local, state, and federal regulations relating to these materials.

B. Demolition Requirements

1. Contractor shall take all precautions during roof demolition to protect the building and adjacent surfaces from being soiled or damaged.
2. Where traffic and/or equipment is required over any in-place roofing systems, the Contractor shall provide the following layers of protection:
   a. Minimum one inch insulation laid directly on the roof surface.
   b. Minimum 3/4 inch plywood traffic surface.
   c. Care shall be taken to secure the protection layers against blow-off or other wind related damage.

3. Plug roof drains during demolition to prevent debris and materials from entering and clogging drainage pipes.
4. Coordinate the roof demolition work with the new roofing work in such a manner as to keep the new insulation and roofing materials, building, and building interior dry and watertight.
5. Remove all loose gravel, dirt and foreign debris from the roof area. Use power broom and/or closed vacuum system.
6. Remove all existing stone ballast, where present, roof membrane, flashing, and insulation down to existing deck.
7. Remove defective decking as noted and/or required.
8. Remove obsolete roof penetrations and equipment as noted on plans or designated by the Owner during the Bidding phase.
9. Remove existing pipe support legs.
10. Remove perimeter edge and field of roof sheet metal flashings as specified.
11. Keep roof surface clean of any debris.
12. Replace all missing or damaged drain components as specified.
13. Do not store debris on roof and do not overstress roof deck.
14. Shut off all affected electrical, plumbing, and gas lines and disconnect all electrical, plumbing, gas lines, and ventilation ducts where required to allow for lifting mechanical units.
15. Temporarily displace junction boxes, rooftop conduit and gas lines, or other supports. All required disconnection, modification, and reconnection is to be performed by a licensed mechanical/electrical contractor as applicable to the Work being performed. Schedule shut-offs and disconnections with the Owner.

END OF SECTION 02 22 00

SECTION 02 42 00

SELECTIVE DEMOLITION FOR RESTORATION

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all labor, materials, equipment, and supervision to demolish, haul and dispose of items in accordance with Specifications and Drawings.

B. Work of this Section includes the following:

1. Demolition and removal of designated components to complete the specified Work.
2. Provide shoring prior to / during work as required to maintain structural stability.
3. Demolition and removal of designated building equipment and fixtures.
4. Cutting and alterations for completion of Work.
5. Protecting adjacent areas.
6. Disposal of demolished materials.
7. Contain all dust during cutting and grinding of masonry and concrete materials using dust-collection systems, or other approved means.

1.02 REFERENCES

A. References are latest editions, unless otherwise indicated.

B. American National Standards Institute (ANSI):

1. Safety Requirements for Demolition, Document A10.6.

C. Occupational Safety and Health Administration (OSHA):

1. Construction Safety Act, Part 1926.

D. National Fire Protection Agency (NFPA):

1. NFPA 241: Standard for Safeguarding Construction, Alteration, and Demolition Operations.

E. Environmental Protection Agency (EPA) regulations related to construction practices and the scope of work of the project.

1.03 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.

B. Existing: Existing items of construction that are not to be removed, salvaged, or recycled.

1.04 PERFORMANCE REQUIREMENTS

A. The responsibility for planning and the effective implementation of the Work, as well as safety to persons and property, are the responsibility of the Contractor. This responsibility shall not transfer to the Owner, Consultant or governing authorities.

B. Prior to demolition, examine areas and conditions under which the Work is to occur and notify the Consultant immediately in writing of any conditions detrimental to the proper and timely completion of this Work.

C. A review of the Contractor's means and methods will be performed by the Owner for general conformance with the requirements of this specification. This review shall not imply agreement by the Owner, Consultant or other governing authorities that the Contractor's planning is appropriate or reasonable.

D. Review with the Owner and Consultant the proposed types of equipment to be used during the course of the project.

E. Provide all necessary precautions to prevent unauthorized personnel from entering the job site.

F. Conduct demolition operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.

G. Protect adjoining properties, public thoroughfares, sidewalks, and utilities from damage due to this operation.

H. Provide all necessary protection to prevent airborne construction material, debris, dust, fumes, etc. from entering process water, process tanks, occupied spaces (e.g. adjacent building, air intake).

I. Structural Support Systems: The structure is designed to be self-supporting and stable after it is fully completed. It is the Contractor's responsibility to determine the erection procedures and sequence, and to ensure the safety and stability of the structure and its component parts during the construction process. This includes, but is not limited to, providing and maintaining temporary bracing, shoring, guys or tie downs and all necessary safety and fire-fighting equipment. Temporary elements shall remain in place until all structural components are in place and completed.

1.05 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner that may be encountered during building demolition remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1. Coordinate with Owner, who will establish special procedures for removal and salvage.

1.06 SUBMITTALS

A. Written plan of the demolition procedures and protection measures with sufficient detail necessary to ensure that the Work can be accomplished in a safe and prudent manner.

B. Proposed Environmental-Protection, Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed location, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

C. Plan of Demolition Activities:

1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
2. Interruption of utility services, including any required certificates of severance.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Locations of temporary protection and means of safe egress for building occupants.
5. Proposed method of traffic maintenance and required permits by local governing agencies or authorities.
6. Coordination of Owner's continuing occupancy of adjacent buildings and use of premises.
7. Required permits for transport and disposal of debris.
8. Temporary barricades and shoring plan.

D. Pre-Existing Conditions Report: Contractor shall prepare written documentation, with associated photographs, of existing conditions of areas / item that are not scheduled to be repaired, adjoining construction, landscaping in the area of work, etc., including finish surfaces, which might be misconstrued as damage caused by the demolition operations. Do not proceed to the work until the report is submitted to and approved by the Consultant.

E. Inventory: Submit a list of items that have been removed and salvaged after completing demolition of specified building components.

F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.07 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Pre-Construction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 – Project Meetings. The items of discussion may include, but are not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review and finalize demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review requirements of work performed by other trades that rely on substrates exposed by demolition operations.
4. Review and finalize protection requirements.

1.08 PROJECT CONDITIONS

A. Maintain access to existing walkways, exits, corridors and other adjacent occupied or used facilities. Do not close or obstruct walkways, exits, corridors, or other occupied facilities without written permission from authorities having jurisdiction.

B. Hazardous Materials: Hazardous materials are not expected to be encountered in Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the Owner and Consultant.
2. Hazardous materials will be removed by the Contractor using an allowance specified in the Bid Form.

C. Storage of hazardous materials on-site will not be permitted.

D. Asbestos Containing Materials (ACM):

1. All products of demolition containing asbestos shall be removed and properly disposed of in conformance to EPA requirements, as well as any local, state, and federal regulations relating to these materials.
2. The Owner will provide a Manifest Form for ACM to be removed and dumped. The hauler and dump site must both be state approved. The Manifest Form must be filled out with each load of material that is hauled and dumped.
3. Dumpsters shall be double lined in accordance to local, state, and federal regulations. Materials shall be disposed of in an approved Type II landfill. Documentation will be required to confirm proper disposal.

E. Utility Service: Maintain existing utilities in service and protect them against damage during selective demolition operations.

F. Fire Protection: Maintain fire-protection services during selective demolition operations.

1.09 SEQUENCING & SCHEDULING

A. Scheduling of the work shall be coordinated with the Owner. Contractor shall be prepared to modify or revise the plan as necessary to accommodate the Owner's requirements. The schedule shall include the number of days that are required for each area of work, coordination and sequencing between demolition and replacement, as well as disposal of materials.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition.

B. Review Project Record Documents of existing construction as may be provided by the Owner. The Owner does not certify that existing conditions are the same as those indicated in Project Record Documents.

C. Inventory and record the condition of items to be removed and salvaged.

D. Any unanticipated conditions not shown on Drawings or indicated in Specifications are to be reported to the Consultant in writing.

E. Verify that hazardous materials have been remediated before proceeding with selective demolition operations.

3.02 PREPARATION

A. Existing Electrical and Mechanical Systems: Temporarily disconnect and remove electrical, plumbing, lightning protection, fire protection lines, etc. as required for Work. This work shall be performed by a licensed Contractor for each trade. Store at Owner's designated location for later re-installation. Upon re-installation, test systems for proper operation.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement, settlement, or collapse of construction being selectively demolished. Strengthen or add new supports as required, or as directed by Consultant, during the progress of selective demolition.

1. Masonry Openings:
   a. Up to than 24 inches in height: Provide continuous horizontal members to support the brick masonry remaining above the opening. The horizontal members shall be rigid enough to support the masonry without deflection between vertical members. Provide vertical members of sufficient strength at 24 inches on center maximum spacing.
   b. Greater than 24 inches in height: Support to be designed by a professional engineer paid by the Contractor, and approved by the Consultant. Do not proceed with the work without review and approval from the Consultant.
   c. The Contractor shall repair cracked masonry due to inadequate / improper support at no cost to the Owner.

C. Temporary Enclosures: Erect and maintain weatherproof, smoke tight and dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise. Use fireproof materials for all temporary enclosures.

D. Temporary Protection: Contractor is responsible for protection and safety in the work area.

1. Protect Work at all times, and protect all adjacent work, materials, landscaping and pavements, by suitable covering or other methods during the progress of the Work
2. Erect, and maintain temporary protection, such as walks, fences, railings, canopies, and covered passageways, including warning signs and lights, where indicated and required by authorities having jurisdiction.
3. Maintain exits at all times from the building(s). Erect protective scaffolding over entrances/exits as required, with a minimum clear height of 6 feet 8 inches.

E. Where traffic and/or equipment are required over any roofing/waterproofing and concrete paving materials, the Contractor shall provide the following layers of protection:

1. Minimum one inch insulation board directly on the roof/waterproofing surface.
2. Minimum 3/4 inch plywood traffic surface.
3. Care shall be taken to secure the protection layers against blow-off or other related damage.
4. Protection shall extend at least 8 feet from the wall / parapet in the areas of work, and all other areas that may be damaged by construction activities (such as access paths to the work

3.03 DEBRIS CONTROL

A. At all times, prevent debris and materials from exiting staging equipment and falling to ground or lower roof levels.

B. Provide netting at interior side of staging basket to contain.

C. Position staging equipment so that work is conducted between waist and chest height to allow for better control of materials. Over-head work shall not be permitted.

D. Adhere to Owners safety policy at all times, including personal protection equipment and protection of surrounding persons / property.

3.04 DUST CONTAINMENT

A. Temporary Enclosures: Erect and maintain weatherproof, smoke tight and dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise. Use fireproof materials for all temporary enclosures.

B. The Contractor shall contain all dust during saw-cutting of masonry and concrete, and any other materials.

C. Use dust-free saw-cutting equipment with integrated vacuum systems. Change filters frequently to prevent dust from escaping.

D. Wet cutting may be considered by the Owner, but must be approved in advance for each location. If wet cutting is used, pre-wet the area to be cut and the entire wall area below. After cutting, thoroughly wash down the entire wall area below to remove all mortar and debris.

3.05 DEMOLITION

A. Coordinate and execute all demolition to ensure that all reconstruction work can be completed once it is begun.

B. Demolish and remove existing construction only to the extent required by new construction or as otherwise indicated. Use methods required to complete selective demolition within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically. Conduct work in an order that avoids transporting removed items and debris through areas of completed Work.
2. Neatly cut openings and holes square and true to dimensions required. Use cutting methods least likely to damage adjoining construction. Whenever possible, use hand tools or small power tools designed for sawing or grinding, to minimize disturbance of adjacent surfaces.
3. Temporarily cover openings at the end of each workday.
4. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
5. Do not use cutting torches until work area is cleared of flammable materials, as approved by the Owner. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations, and maintain adequate ventilation when using cutting torches.

C. Remove and salvage existing items specified or indicated on Drawings.

D. Remove debris from elevated portions by chute, hoist, or other device that will convey debris to grade level in a controlled descent. All debris must be directly placed into trash receptacles at the elevation the work is being performed, and later transported to the ground elevation under safe controlled conditions.

E. Close and seal all heating and ventilation ducts as required to prevent contamination and intake of fumes inside the building. Where ducts can not be closed, as determined by the Owner, provide filtering media for duct and fumes.

F. Protect all glass and metal surfaces in area of Work.

G. Protection of Salvaged Items: Pack or crate designated salvaged materials and equipment after removal. Identify contents of containers. Protect items from damage during transport and storage.

H. Existing Items to Remain: Protect construction items to remain in place against damage and soiling during selective demolition. When permitted by the Owner, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

I. Except for items or materials indicated to be salvaged, reinstalled or otherwise indicated to remain the Owners property, demolished materials will become the Contractor's responsibility and will be removed from the Owner's property.

3.06 REPAIRS

A. General: Promptly repair damage to adjacent construction caused by demolition operations. Provide required repairs due to inadequate protection methods at no cost to the Owner.

B. Where repairs to existing surfaces are required, provide materials and procedures to match existing construction.

C. Restore exposed finishes of repaired areas and extend restoration into adjoining construction in a manner that eliminates evidence of remedial and refinishing procedures.

3.07 ADJUSTING AND CLEANING

A. At the end of each work period, the Contractor shall remove from the premises all rubbish and accumulated materials of any nature not caused by others and shall leave his part of the Work in a clean, orderly and acceptable condition.

B. Disposal of debris shall be the responsibility of the Contractor.

END OF SECTION 02 42 00

SECTION 02 82 00

ASBESTOS REMEDIATION – ROOFING MATERIAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes removal and disposal of asbestos-containing materials by full enclosure, glove bag, or entire structures methods as applicable. Demolition and debris removal of all asbestos-containing materials identified by provisions of this Section, or shown on drawings, or identified at the site, shall be executed under the provisions of this Section, and other applicable sections of these specifications.

B. Extent of asbestos removal work to roofing material is as follows:

1. Roofing Material assumed to include asbestos as identified in Division 00 Section “Information to Bidders,” and as supplemental testing by Owner’s agent delineates.

1.2 RELATED SECTIONS

A. Unit price items are scheduled with related units of measure in the Bid Form.

B. Work of this Section that is affected by alternates is described in Division 01 Section "Alternates."

C. Demolition and removal of items not containing asbestos as a component is included in Division 02 Sections "Selective Demolition for Roofing," "Selective Demolition for Restoration," and "Interior Demolition."

1.3 DEFINITIONS

A. Asbestos Abatement Firm: Firm engaged to perform actual removal and disposal work, either as Contractor or subcontractor.

B. Asbestos Containing Material: The term "asbestos containing material" is abbreviated ACM.

C. Owner's Consultant: Firm engaged by Owner to identify and measure asbestos containing materials, or to inspect demolition operations, including monitoring of air quality.

1.4 SUBMITTALS

A. Initial Submittals: Submit the following documents to Owner's Representative at the pre-abatement meeting:

1. Copy of notification sent to appropriate federal, state, and local agencies (when applicable).
2. Schedule of removal, specifying work locations, length and number of shifts, foreman's name, and crew size.

3. Disposal Site Certification: Letter, signed by the Contractor, certifying that an approved asbestos-accepting type II landfill will be used for disposal. Include the facility name, address, and phone number.

B. Waste Disposition Submittals: Submit to Owner signed waste shipment record stating that asbestos waste has been properly disposed. Submit the following:

1. Receipts (trip tickets) from approved landfill.
2. Asbestos Waste Shipment Record: As follows:
   a. Prior to removing asbestos-containing material from the project site, provide Owner's Representative or Owner's consultant with a completed waste shipment record fully complying with Section 61.150 of the NESHAP standard, and 49 CFR Part 172.200 of the U.S. Department of Transportation, and including all required information.
   b. Ensure that the landfill operator provides a signed copy of the waste shipment record to Owner within 35 days of the date that asbestos-containing material is removed from the project site. If waste is not transported directly from the project site to the landfill, the waste shipment record shall reflect each transfer.
   c. The Owner will not make final payment prior to receipt of signed waste shipment record.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 ASBESTOS ABATEMENT, GENERAL

A. Conduct asbestos abatement operations in a manner that fully protects Contractor's and subcontractor's employees, the general public, and building occupants from exposure to asbestos and other safety and health hazards.

1. Asbestos abatement projects shall be directly supervised by a competent person as described in 29 CFR 1926.1101.
2. The supervisor/competent person must complete responsibility checklists throughout all phases of the project.

B. Protect adjacent areas, materials and surfaces from damage due to demolition operations, including but not necessarily limited to the following:

1. Water damage.
2. Dirt, dust and debris.
3. Abrasion.
4. Cuts and scratches.
5. Holes from fasteners for temporary barriers.

C. All asbestos work shall be conducted within a regulated area that complies with the following requirements:

1. Post a sufficient number of signs required by 29 CFR 1926.1101 at the asbestos abatement area and at every work area entrance, so that tenants, Owner's personnel, and other contractor's employees have an opportunity to take protective measures before exposing themselves to asbestos. Place banners if necessary to secure open areas. Include information on signs indicating location and quantity of asbestos-containing material.
2. Allow only authorized, properly protected personnel to enter the regulated area. Immediately report unauthorized individuals entering the work area to Owner or the Owner's consultant.

D. When required, provide employees and inspectors authorized to enter the regulated area with protective work clothing consisting of disposable Dupont "Tyvek" (or equivalent) full body coveralls, head covers, boots, and other necessary safety gear, including a hard hat and eye protection.

E. Provide respiratory protection to employees as required by current OSHA regulations including 29CFR 1910.134 and 1926.1101.

1. Provide asbestos abatement workers with powered air purifying respirators (PAPR) with full facepiece and HEPA filters for adequate protection during asbestos material removal operations. Respiratory protection may be down-graded if negative exposure assessment indicates that less protection is required.
2. A half-face respirator or PAPR must be worn while tearing down and setting up enclosures, while glovebagging, and during pre-cleaning and post-cleaning work.
3. Do not allow respirators to be pulled away from faces while in the work area.
4. Maintain an extra PAPR unit on site at all times for the duration of the abatement project.
5. Provide full facepiece supplied-air respirators operated in pressure demand mode equipped with air auxiliary and pressure self-contained breathing apparatus or HEPA egress filters if required for measured fiber concentrations.

F. Maintain at each job site and post the following documents:

1. Copy of MDEQ/MDLARA notification (when applicable).
2. Employee respiratory protection program (when applicable).
3. Michigan Right-To-Know poster.
4. Material Safety Data Sheet locator.
5. Company standard operating procedure.
6. This specification Section.
7. Material Safety Data Sheets for products used on job.
8. CFR 1926.1101.
9. CFR, Part 61 (NESHAP).
10. The foreman's or supervisor's Contractor/Supervisor Accreditation Certificate.
11. State of Michigan Accreditation Certificates and Medical Approval for each worker (when applicable).

G. Use the following engineering controls and work practices for all asbestos abatement operations, regardless of measured exposure levels:

1. Vacuum cleaners equipped with HEPA filters to collect all asbestos-containing dust and debris.
2. Wet methods to control exposures during asbestos removal and clean-up, except where proven to be infeasible.
3. Prompt clean-up and disposal of asbestos-contaminated wastes and debris in leak-proof containers.
4. Establish a decontamination area, adjacent and connected to the regulated area, if the Project requires the removal of more than 25 lin. ft., or 10 sq. ft. of thermal systems insulation or surfacing ACM.
5. Establish an equipment area adjacent to the regulated area if the Project requires the removal of less than 25 lin. ft. or 10 sq. ft. of thermal systems insulation or surfacing ACM.

H. Do not use any of the following equipment or work practices during asbestos abatement operations, regardless of measured exposure levels:

1. High-speed abrasive disc saws not equipped with point-of-cut HEPA ventilation or HEPA filtered exhaust air enclosures.
2. Blowing with compressed air to remove asbestos-containing materials.
3. Dry sweeping, shoveling, or other dry methods to clean up asbestos-containing dust and debris.
4. Employee rotation as a means of reducing employee exposure to asbestos.

3.2 FIELD QUALITY CONTROL

A. Pre-Notification of Owner: To permit adequate time to schedule air monitoring, notify the city project representative not less than 10 calendar days prior to planned start of all removal operations.

1. Roofing removal Contractors may provide their own air monitoring in compliance with roofing removal requirements of this Section.

B. Inspection: If during the project, if Owner’s representative or Owner's consultant determines that work practices either violate applicable rules and regulations or endanger employees, the Contractor's on-site representative shall stop operations immediately and take corrective action. Cooperate fully with Owner’s representative and Owner's consultant.

3.3 REMOVAL OF NON-FRIABLE ASBESTOS-CONTAINING MATERIALS

A. Removal of Non-Friable Materials, General: For each type of non-friable asbestos-containing material indicated, comply with the following requirements:

1. Comply with requirements of Article 3.1 of this Section.
2. Conduct non-friable material removal operations to prevent the material from becoming friable during the removal and disposal process. No visible emissions are permitted. If the material does not remain substantially intact, comply with the requirements for friable asbestos removal specified in Articles 3.2 of this Section (except roofing removal).
3. Place impermeable dropcloths on surfaces beneath removal activity.
4. Do not conduct asbestos removal unless the Owner's Consultant is present at the site and Owner has been notified. For roofing removal projects, notify Owner prior to start of work.

5. Labeling Containerized Waste: Comply with the requirements of Article 3.2, paragraphs B.9.a. through c. of this Section.

B. Non-Friable Asbestos-Containing Roofing Materials: Non-friable asbestos-containing roofing materials may be removed in a non-friable state. This specification does not apply to removal of intact cements, coatings, or mastics. Obtain Owner's review and approval of planned removal operations prior to beginning. Remove non-friable asbestos-containing roofing materials in using the following technique:

1. Each employee who is likely to disturb or handle asbestos material shall have completed an 8-hour training class, and the project shall be supervised by a competent person who has completed the appropriate contractor/supervisor course.
2. Isolate roof level heating and ventilation air intake sources within the regulated area and others that will be affected; or arrange for shut-down the affected ventilation system during removal operations. Acceptable isolation techniques include the following:
   a. Use 20-foot or larger buffer zones.
   b. Installation of HEPA filters over the air intakes.
   c. Erection of horizontal or vertical extensions that relocate the opening of the intake outside or above the regulated area.
   d. Covering the intake with plastic sheeting or other appropriate barrier.
3. Personal protective equipment (PPE), including disposable coveralls and NIOSH approved appropriate high efficiency particulate absolute (HEPA) respirators, shall be worn by personnel if the asbestos containing material is not removed in an intact state.
4. Remove roofing material in an intact state.
5. Use wet methods to remove materials that are not intact, or that are rendered not intact during removal, except where wet methods will create a safety hazard or are otherwise not feasible.
6. Continuously apply a water mist to the blade of power cutting tools, unless a competent person determines that misting will substantially decrease worker safety.
7. When removing roofing felts, collect the dust generated by power roof cutters with a HEPA-filtered dust collector; or immediately vacuum using a HEPA-filtered vacuum along the cut line. For smooth surfaces only, gently sweep wet dust generated from cutting operations, and carefully and completely wipe up the still-wet dust and debris.
8. For removal and repair operations of intact roofing less than 25 sq. ft. in area, the use of wet methods or HEPA vacuuming is not required, provided manual methods do not render the material non-intact and no visible dust is created.
9. Do not drop or throw to the ground asbestos-containing roofing material that has been removed. As soon as practicable, but not later than the end of the work shift, lower debris to ground either by passing or carrying by hand, or by lowering to the ground in a covered, dust-tight chute, crane or hoist.
   a. While on the roof, keep non-intact asbestos-containing materials wet; or seal in impermeable waste bags, or wrap in plastic sheeting.
   b. While on the roof, intact asbestos-containing material is not required to be kept wet, bagged, or wrapped.

10. Upon being lowered to the ground, transfer unwrapped material to a closed receptacle in manner that precludes the dispersion of dust. Dispose of the material in an asbestos-accepting Type II landfill. Notify the landfill that the roofing material contains asbestos and provide waste shipment records to Owner within 35 days.
11. For removal of intact pipeline asphaltic wrap or roof flashings that contain asbestos, engage a competent person to examine the material and determine whether the material is intact and likely to remain intact during removal. Remove the material using manual methods. Sanding, grinding, or other abrading operations are not permitted. Do not throw or drop materials to the ground. Lower the material in a covered, dust-tight chute, crane, or hoist. Remove debris from the roof at the end of the work shift.

3.4 SCHEDULE OF ITEMS CONTAINING ASBESTOS

A. Bidding Requirements: Comply with the following requirements related to bidding:

1. Survey quantities provided are approximate. Bidders are required to field investigate as necessary and assume all responsibility to verify the work required and quantities involved for complete asbestos abatement.
2. The building is open for field inspection by all bidders during the bidding period.
3. A "pre-bid orientation meeting" will be conducted to familiarize prospective bidders with site conditions and provide for verification of marked and scheduled quantities, as applicable.

B. The following items have been surveyed and determined to have asbestos as a component:

1. All Roofing Material

END OF SECTION 028215

SECTION 02 90 10

LANDSCAPING FOR ROOFING AND RESTORATION

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish all labor, materials, equipment and supervision to remove and replace any landscaping damaged by the contractor during the performance of Work.

1.02 SUBMITTALS

A. Product Data

1. Submit data indicating material characteristics, performance criteria, and any limitations.
2. Submit manufacturer's installation instructions indicating preparation, installation or other specific procedures to be followed during installation.

1.03 QUALITY ASSURANCE

A. Qualifications of Workmen: Provide at least one person who shall be present at all times during execution of this portion of the Work, who is familiar with the type of materials being installed and the proper methods for their installation, and who shall direct all Work performed under this section.

B. Protect structures, utilities, roads, trees and vegetation from damages caused by landscaping operations.

C. Standards:

1. All plants and planting material shall meet or exceed the specifications of federal, state, and local laws for plant disease and insect control.
2. Quality and size of materials shall conform to the current edition of *Horticultural Standards* for number one grade nursery stock as adopted by the American Association of Nurserymen.

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage:

1. Deliver all items to the job site in their original containers with all labels intact and legible.
2. Protect plant materials before, during, and after installation and to protect the work and materials of all other trades.

B. Replacements: In the event of damage to stored materials, make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the owner.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Topsoil required to complete the work of planting shall be natural, friable topsoil, characteristic of representative soils in the vicinity that produce heavy growths of crops, grass or other vegetation. It shall not be too acidic, nor too alkaline, or contain toxic substances harmful to plant growth. All topsoil used for this project shall be without admixtures of subsoil; free from clay lumps, stones, roots, debris and other objects.

2.02 SEED

A. Premium Grass Seed – mixture of ryegrass, bluegrass, and fine fescue grass seed.

B. Supplier – Contractor to submit to Consultant for review prior to installing.

2.03 FERTILIZER

A. Fertilizer shall meet the applicable sections of the State Highway Specifications.

B. Fertilizer shall be uniform in composition, free flowing and suitable for application with approved equipment.

C. Fertilizer shall meet the City of Ann Arbor requirements for phosphorus.

PART 3 - EXECUTION

3.01 INSPECTION

A. Ground preparation shall not be started until all stones, debris, and similar material larger than 1" in diameter have been removed, depressions and ruts filled and the entire area to be seeded and/or sodded has been accepted by the Consultant.

3.02 PROTECTION OF PERSON AND PROPERTY

A. Protection of Existing Plant Materials

1. Existing trees, shrubs, and plant materials to remain shall be protected by acceptable means.
2. Damage to above plant material shall be repaired by qualified personnel and replaced with Owner approved material.

3.03 TOPSOIL

A. Place topsoil in location requiring landscaping repairs, a minimum thickness of 4".

B. Topsoil shall be compacted and conform to the surrounding grades and elevations. Water shall be applied as necessary to provide adequate moisture content prior to installation of any sod or seed.

3.04 SEEDING

A. General lawn repair shall be performed by those familiar with the accepted procedures of planting and under the supervision of a qualified planting foreman.

B. Preparation for Seeding

1. Prior to, but not in excess of 24 hours before seed is to be placed, the soil surface shall be worked until it is free from debris, washes, gullies, clods and stones and is in satisfactory condition.
2. The surface shall be worked to a depth of not less than 3” with a disc, tiller, or other equipment approved by the Owner’s Representative.
3. Prepared surfaces that become crusted shall be reworked to an acceptable condition before seeding.
4. Broadcast seed over prepared area per manufacturer’s requirements.

C. Application of Starter Fertilizer

1. Commercial starter fertilizer shall be applied in accordance with the State Highway Specifications.

D. Mulch - provide and install mulch blankets anchored with landscaping stakes. Netting shall be biodegradable.

E. Water - water seed until fully established.

END OF SECTION 02 90 10

SECTION 03 30 10

CAST-IN-PLACE CONCRETE FOR ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes the following:

1. Provide labor, equipment, materials, and supervision to repair cast-in-place concrete, as required.
2. Install new 1/8 inch steel plate over abandoned deck openings less than 24 inches square.
3. Install new steel angles and steel deck in-fill at deck openings greater than 24 inches square.

B. Unit Prices

1. Replacement, repairs or in-fill of cast in place concrete deck other than those shown on the roof plan, will be paid for on a unit price basis, as listed in the bid form.

C. Perform all work in strict accordance with all applicable laws and regulations of the Building Code and with all other authorities having jurisdiction, which shall take precedence over the requirements of the specifications, except that where the requirements of the specifications are more exacting or stringent, they shall govern.

D. Before commencing Work, examine all adjoining Work on which this Work is dependent and report in writing to the Owner and the Consultant any condition which prevents Contractor from performing the work. Starting work constitutes acceptance of adjoining work.

E. Verify exact sizes and locations of all openings, pipe sleeves, concrete pads or curbs, etc., well in advance so that any required adjustments, Consultant approved, in reinforcing or locations may be made without interruption of the Work schedule.

F. Install all materials specified under other sections which are required to be built into the work covered by this section such as wedge inserts, welding plates, anchors, ties, dovetail anchor slots, etc. Embedded items shall have been inspected and tests for mechanical operations, if any, shall have been completed and approved by the Consultant before placement of any concrete.

1.02 REFERENCES

A. Conform to the latest edition of the following Codes and Standards:

1. ACI-306 "Recommended Practice for Cold Weather Concreting", by the American Concrete Institute.
2. ACI-305 "Recommended Practice for Hot Weather Concreting", by the American Concrete Institute.
3. ACI 318 “Building Code Requirements for Reinforced Concrete”, by the American Concrete Institute.
4. ACI-614 "Recommended Practice for Measuring, Mixing, and Placing Concrete", by the American Concrete Institute.
5. Standards of the American Society for Testing and Materials (ASTM), as cited.
6. AWS D1.1, "Structural Welding Code-Steel", by the American Welding Society.
7. AWS D1.4, "Structural Welding Code-Reinforcing Steel", by the American Welding Society.
8. Standard Practice for Curing Concrete: In accordance with ACI 308.

1.03 PERFORMANCE REQUIREMENTS

A. Inclement Weather:

1. Unless adequate protection is provided, concrete shall not be placed during rain, sleet, or snow.
2. Rain water shall not be allowed to increase mixing water or to damage the surface finish.

1.04 SUBMITTALS

A. Product Data: Provide data on cleaning compounds, cleaning solutions, and repair materials.

B. Product Data:

1. Product manufacturer's specifications, recommendations and installation instructions for joint devices, attachment accessories, and associated materials.
2. Manufacturer's published data, letters of certification, or certified test laboratory reports indicating that furnished materials comply with the project requirements and are suitable for applications shown.
3. Manufacturer Installation Instructions: Indicate installation procedures and interface required with adjacent Work.

1.05 QUALITY ASSURANCE

A. Restorer: Company specializing in concrete restoration with a minimum 10 years documented experience.

B. The precast manufacturer’s plant shall be certified by the Pre-stressed Concrete Institute plant certification program prior to letting of this contract. If requested, submit verification of this certification to the Consultant for review.

C. Keep plant records of production and quality control in accordance with PCI-MNL-116- “Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products”. Provide copies of reports to the Consultant on a bi-weekly basis during production.

D. Maintain a record of all units that are damaged in plant operations or are rejected. These records shall show what remedial action was taken to obtain approval. Record finishing and patching procedures as well as patch mix designs. All plant patching to be accepted by Consultant prior to shipping to job site.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store restoration cleaner materials and repair materials in manufacturers packaging.

1.07 PROTECTION

A. Protect elements surrounding the work of this section from damage or disfiguration.

B. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.

C. Protect roof membrane and flashings from damage. Install one layer of 6 mil polyethylene and 1/2 inch plywood on roof surfaces over full extent of work area and traffic route.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to a minimum of 50^{o} F. prior to, during, and 48 hours after completion of masonry work.

1.09 SCHEDULING

A. Coordinate work with that of other trades to allow reasonable time to set sleeves, inserts and other accessories.

B. Notify the Consultant and the testing agency at least 48 hours prior to placing any concrete.

PART 2 - PRODUCTS

2.01 CONCRETE DECK REPAIR MATERIALS AND HARDWARE

A. Two Component bonding and anti-corrosion agent

1. Sto-CR246 epoxy-acrylic based bonding agent/anti-corrosive by Sto Concrete Restoration Division, Atlanta, GA

B. One component, chemical action concrete

1. Below 80° F.: "Set-45" by Master Builders Division, Martin-Marietta Corp., Cleveland, OH
2. Above 80°F: "Set-45 Hot Weather Formula" by Master Builders Division, Martin-Marietta Corp., Cleveland, OH

C. Metal plating for covering abandoned deck openings less than 24 inches square shall be ⅛ inch by 36 inch square (minimum), cold rolled steel plate.

D. Metal decking for in-filling of abandoned deck openings exceeding 24 inches square shall be 1½ inch, 22 gauge, Type B steel decking meeting ASTM A611 with factory applied prime coat.

E. All anchor bolts, inserts, or angles shall be galvanized or epoxy coated and they have sufficient anchorage and embedment for the design requirements. Unless furnished by

F. Steel angles for securing new metal deck insert section shall be 4” x 4” x 1/4”.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces to be cleaned and restored are ready for Work of this section.

B. Report all openings without external reinforcing to the Consultant for review prior to performing the Work of this section.

3.02 CONCRETE ROOF DECK REPAIRS

A. Deck Repairs (Cast-in-Place Concrete)

1. Chip away and remove all loose concrete until a sound base has been reached.
2. Wherever rebar is exposed and rusting, remove all loose rust by power wire brushing.
3. When time and good drying conditions permit, allow the concrete surfaces to become visibly dry. Otherwise use a propane torch to carefully force dry the surfaces.
4. Apply epoxy coating and encapsulate all exposed rebar.
5. Affix repairs with approved systems and procedures.

3.03 PLACING CONCRETE AND CONCRETE PATCHING MATERIALS

A. Prior to concrete placement, all preparation, must be inspected by the Consultant.

B. Before placing concrete, formwork, if required, shall have been completed; foreign material shall have been removed, reinforcements shall have been secured in place and the entire preparation shall have been approved by the Consultant prior to placing concrete. The Consultant shall be notified at least 24 hours prior to desired time of inspection.

C. Prior to the placing of concrete, the Contractor shall clean all cavities and forms of foreign matter and remove all wood spreaders. Convey concrete from mixer to destination as rapidly as practical and by methods which will prevent segregation or loss of ingredients. Concrete shall be poured in one operation. The bonding surface shall then be coated with a thin layer of bonding grout immediately prior to placement of concrete. The bonding grout shall be worked into the bonding surfaces with stiff brooms or brushes.

D. Place concrete only when temperature is at least 40^{o}F. and rising. If these conditions are not met, refer to ACI 306 "Cold Weather Concreting".

E. When concrete is placed under conditions of hot weather concreting or hot weather conditions exist at any time during the day of the pour, provide extra protection of the concrete against excessive placement temperatures and excessive drying throughout the placing and curing operations.

F. Repairs: Restore the deck to surfaces having suitable smooth contours by filling depressions with a quick-setting grout such as Unibond 275, Set 45, or other approved equivalent.

G. Concrete patches shall be edged to match existing condition (beam and column edges, etc.), unless noted.

3.04 CONCRETE SURFACE PREPARATION

A. Repair areas of defective concrete as specified. Concrete and concrete patching materials shall be cured according to the manufacturer's recommendations.

B. Following proper curing, roof deck surfaces shall be cleaned of all dirt, dust, debris or other foreign matter.

C. Verify all concrete surfaces are dry prior to application of specified primer. Following verification, prime all concrete surfaces to receive new roofing and/or flashing with specified asphalt cut-back primer. Apply primer over substrate surfaces at coverage rates recommended by the primer manufacturer.

3.05 DECK ABANDONMENTS (OBSOLETE PROJECTIONS/OPENINGS)

A. Steel Plating (Abandoned Deck Openings Less than 24" square)

1. Remove all existing abandoned equipment, curbing, framing or securement hardware.
2. Remove all roof system components down to deck surface.

3. Install specified steel plating over deck opening. Plating shall have a six (6) inch minimum bearing on all surrounding edges or sides of deck opening.
4. Mechanically attach plating to substrate surface with specified fasteners. Minimum securement shall be four (4) fasteners per opening.
5. Prime top surface of plating and adjoining surfaces with specified asphalt primer and allow to dry thoroughly prior to installation of roof system components.
6. Seal sides of plating with specified flashing cement.

B. Metal Deck In-Fill (Openings exceeding 24" square)

1. Remove all roof system components down to the deck surface.
2. Remove all existing abandoned equipment, curbing, framing or securement hardware.
3. Inspect sides of deck opening to ensure substrate surfaces are sound and free of defects prior to installation of specified components.
4. Around all sides of openings, mechanically attach specified steel angles to concrete decking with 2 inch expansion bolts placed a maximum of 24 inches on center, and within 12 inches of end runs.
5. Install specified steel roof deck over new framing members. Adjoining deck panels shall be overlapped one (1) rib minimum.
6. Place deck units flat and square, without warping or deflection. Provide a maximum 1/4 inch spacing between edges of decking and existing substrate surfaces.
7. Steel roof deck shall be anchored to the steel angles through the bottom of the rib by using specified self drilling screws.
8. Screws shall be a maximum 12 inches on center and within one (1) inch of ends.
9. For spans greater than five (5) feet, side laps shall be fastened together not exceeding 24 inches on center.
10. Verification: Upon completion of the installation in each area, visually inspect and verify that all components are complete and installed.

END OF SECTION 03 30 10

SECTION 03 93 00

CONCRETE PATCHING AND RESTORATION

PART 1 - GENERAL

1.01 SUMMARY

A. Provide labor, materials, equipment and incidentals required for repair and restoration of damaged, deteriorated, or previously patched concrete areas.

B. Work of this Section includes the following:

1. Removal of deteriorated concrete areas to provide a suitable substrate for the following surface orientations:
   a. Vertical repairs.

2. Prepare and patch areas of deteriorated concrete.
3. Repair of existing embedded steel reinforcing components.
4. Preparation and coating of existing embedded steel reinforcing components.
5. Crack injection, including removal of all surface sealants and injection ports, and patching injection ports when injection is complete.
6. Saw-cut existing expansion joints in concrete wall system to widen joint for sealant installation.

C. All new materials are to be interfaced with, and integrated into, existing materials to provide completed work that is sound.

1.02 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Concrete Removal and Patching:

1. Basis of Measurement: By the square foot, computed on the basis of rectangular solid shapes approximating the actual shape of concrete removed and replaced with average depths, widths, and lengths, measured to the nearest inch.
2. Basis of Payment: Includes removals, surface preparation, treating existing reinforcement, concrete repair, and finishing.
3. Payment will be based on orientation of repairs.

B. Crack Injection:

1. Basis of measurement: By the linear foot of crack injected.
2. Basis of Payment: Includes surface preparation, injection ports, repair materials, and surface finishing.

1.03 REFERENCES

A. References are latest editions, unless otherwise indicated.

B. American Society for Testing and Materials (ASTM):

1. ASTM A 82: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A 615: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. ASTM A 996: Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete reinforcement.
4. ASTM C 33: Specification for Concrete Aggregates.
5. ASTM C 109: Standard Test Method for Compressive strength of Hydraulic Cement Mortars (Using 2-inch or (50 mm) Cube Specimens).
6. ASTM C 150: Specification for Portland Cement.
7. ASTM C 260: Air Entraining Admixtures for Concrete.
8. ASTM C 293: Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading).
9. ASTM C 404: Standard Specification for Aggregates for Masonry Grout.
10. ASTM C 882: Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete By Slant Shear.
11. ASTM C 1042: Standard Test Method for Bond Strength of Latex Systems Used With Concrete By Slant Shear.
12. ASTM C 387: Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.

C. Concrete Reinforcing Steel Institute (CRSI):

1. Manual of Standard Practice.

D. American Welding Society (AWS):

1. AWS D 1.4: Structural Welding Code – Reinforcing Steel

E. American Concrete Institute (ACI):

1. ACI 301: ACI Specification for Structural Concrete of Buildings.
2. ACI 318: Building Code Requirements for Structural Concrete.

F. The Society for Protective Coatings (SSPC):

1. SSPC: Steel Structures Painting Manual.

1.04 SUBMITTALS

A. Product Data: Submit product standards, physical and chemical characteristics, technical specifications, test data, limitations, maintenance instructions, and general recommendations regarding each material.

B. Samples: Submit two samples of the following:

1. Color samples for cured patches exposed to view in finished construction andrequired to match existing.
2. Fine and coarse finish aggregate to match existing precast panels and/or concrete.

C. Manufacturer's instructions: Submit mixing and application instructions.

D. Manufacturers Certificate: Certify Products meet or exceed specified requirements and are recommended by manufacturer for uses indicated.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of bonding agents, patching mortars, epoxy adhesives, and structural reinforcement with requirements indicated.

F. Restoration Program for each phase of the restoration process, including protection of surrounding materials and Project site during operation. Describe in detail the materials, methods, equipment, and sequence of operations to be used for each phase of the Work.

1.05 QUALITY ASSURANCE

A. Contractor Qualifications: Not less than five (5) current years relevant successful experience with comparable projects and employing skilled personnel trained and approved by manufacturer to apply the required scope of work. The skilled person shall have at least five (5) years of experience and shall have successfully completed at least two (2) projects within the past three (3) years involving quantities and complexities similar to those required under this Section.

B. Source of Materials: Obtain materials from a single source for each type required (cement, aggregate, etc.) to ensure quality, color, match, and texture.

C. Manufacturer Representatives: Manufacturer representatives shall visit the site at the start of and during the course of the project to review the work in progress and verify that the work is meeting the requirements.

D. Perform welding work in accordance with AWS D 1.4.

E. Design reinforcement splices under direct supervision of Professional Engineer experienced in design of this work and licensed in the state of the project.

F. Pre-Installation Conference: Convene prior to commencing Work of this Section, with the Owner and Consultant to discuss sequencing and installation procedures.

G. Field Samples

1. Sample concrete patch, approximately 2 feet long by 2 feet.
2. Epoxy injection at two locations, approximately 10 lineal feet in length each.
3. Incorporate accepted field sample as part of the Work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Coordinate locations for on-site staging and storage areas with the Owner.

B. Deliver and neatly store materials on job site in a manner that prevents damage, contamination or breakage and with packages intact displaying labels identifying manufacturer, product name, and lot numbers when appropriate.

C. Store materials in accordance with manufacturer's recommendations.

1.07 PROJECT CONDITIONS

A. Protect elements surrounding the work of this Section from damage or disfiguration.

1.08 WARRANTY

A. Reference Section 01 78 00 – Project Closeout and Warranties.

PART 2 - PRODUCTS

2.01 GENERAL

A. Listed are primary products and materials for the specified repair work. Provide all incidental items and materials required for completion of the Work in accordance with these documents.

2.02 SPECIALTY CONCRETE

A. Materials

1. Vertical Repairs:
   a. Sikatop 123 Plus by Sika Corporation.
   b. Conpro Set by Conproco.
   c. Gel Patch by MTB / BASF.

2. Form-and-Pour Repairs (Vertical):
   a. Emaco R310 CI by MTB / BASF.
   b. Sikacrete 211 SCC Plus by Sika Corporation.

3. Vertical Repairs (Precast):
   a. Jahn M90 Restoration Mortar for structural concrete

2.03 BONDING AGENTS

A. Specialty Concrete: As recommended by the specialty concrete manufacturer.

2.04 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A 615, Grade 60 ksi yield grade billet-steel deformed bars, epoxy coated in accordance to ASTM A 884 finish. Size to match existing.

B. Tie Wire: #16 gauge tie wire.

C. Patch reinforcing: stainless steel threaded rod (epoxied-in) 1/8" min diameter

D. Coating for Cut Bars:

1. Tnemec-Zinc 90G-1K97 by Tnemec Co., Inc.

2.05 CRACK INJECTION

A. Injection Grout (Precast):

1. Mineral-Based Jahn Injection Grouts distributed by Catherdral Stone Products In., 7266 Park Circle Drive, Hanover, MD 21076; tel. (410) 782-9150; contact Zachary Beach.
2. Product Description:
   a. Jahn M30 Micro Injection Adhesive (for hairline cracks up to 3/16" or 5.0mm in width).
      1) #31 for Concrete and hard stone
   b. Jahn M40 Crack and Void Injection Grout (for cracks approximately 3/16" to 3/8" or 5.0mm to 10.0mm in width)

B. Epoxy Injection Materials:

1. Eucopoxy Injection Resin by Euclid Chemical Co.
2. SikaDur 52 by Sika Corporation.

2.06 CONVENTIONAL CONCRETE AND REPAIR MORTAR MIXES

A. Mix products in clean containers according to manufacturer’s written instructions.

1. Add clean silica sand and coarse aggregates to products only as recommended by manufacturer.
2. Do not add water, thinners, or additives unless recommended by manufacturer.
3. When practical, use manufacturer’s pre-measured packages to ensure that materials are mixed in proper proportions. When pre-measured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit or measure.
4. Do not mix more materials than can be used within recommended open time. Do not re-temper mixes that have begun to set-up, set materials shall be discarded.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine existing conditions in the area of work and verify that no conditions are present that prevent or otherwise interfere with the specified Work.

B. For horizontal repairs, after all existing overburden has been removed, the Contractor is responsible for visually inspecting and sounding the entire surface of the slabs, including chain dragging the entire surface as required to discover and repair all delaminated and/or spalled concrete.

3.02 PREPARATION

A. Provide proper protection to people, motor vehicles, equipment, surrounding construction, project site, plants, and surrounding buildings from injury resulting from concrete restoration work.

1. Coordinate the temporary closure of entrances and parking areas with Owner. Erect temporary protective covers over pedestrian walkways and at points of entrance and exit for people and vehicles that must remain in operation during the course of concrete rehabilitation work.
2. Provide full height dust barriers and protection around all areas during concrete removals and surface preparation, as required. Temporarily cover or protect ducts, vents, and windows on the building exterior. Coordinate the shutdown of such ducts/vents and closure of operable windows with the Owner. Maintain all barriers and protection until the work in that area is completed.

B. Shoring: Install temporary supports before beginning concrete removal.

3.03 DEMOLITION AND SURFACE PREPARATION FOR CONCRETE AND MORTAR REPAIRS

A. Saw-cut perimeter of area of the repair area to a depth of at least 3/4 inch. Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcing. The saw cuts shall form polygons, in plan, which have at least 90-degree corners and enclosed the damaged area.

B. Where reinforcing bars are present, remove concrete to a minimum depth of 3/4 inch beyond the outmost layer of reinforcement. Remove concrete to such additional breadth and depth as required to expose un-corroded reinforcing bars and a surface of sound uncontaminated concrete. Sound concrete need not to be removed beyond subsequent layers of reinforcement unless either more than 1/2 the perimeter of the bar is exposed or the bond between the bar and concrete is destroyed. Conduct concrete removal in a manner to prevent cutting, nicking, bending, or otherwise damaging the reinforcement. Repair or replace accidentally damaged reinforcement at no cost to the Owner.

C. Remove loose and deteriorated concrete from the area to be repaired. Roughen the concrete surface to receive the patching material to a minimum amplitude of 1/4 inch Remove all loose particles and deleterious materials from the exposed sound concrete and exposed reinforcing bars by sandblasting. Clean reinforcing bars to SSPC SP-3 commercial blast finish, or better.

D. Steel Reinforcement:

1. Where section loss of reinforcing bar is more than 15 percent, report findings to the Consultant for strength evaluation prior to commencing with the Work.
2. Where necessary, cut out and remove corroded bars as directed by the Consultant. Remove additional concrete as necessary to provide at least a 3/4 inch clearance at existing and replacement bars. Splice replacement bars to existing bars with a minimum lap of 40 bar diameters.
3. Coat all exposed existing reinforcing bars with protective coating in accordance with the manufacturer's written instructions.

3.04 FORMWORK – WALL REPAIRS

A. Provide two-sided impermeable forms securely fastened to the existing concrete sufficiently to allow proper compaction of the mortar into the repair area. Forms for ribs shall comprise a bottom form and side form.

3.05 SURFACE PREPARATION AT PLACEMENT

A. Remove all dust and debris from the previously prepared surfaces of sound concrete by sweeping and blowing with oil-free compressed air.

B. Conventional Concrete and Mortar: After the surface has been cleaned, and at least one hour before placing the concrete, pre-wet the bonding surface with a uniform spray application of water, puddles shall be blown clean. Surface shall be maintained in a saturated surface dry (SSD) condition. Immediately before placing concrete, a thick coating of bonding slurry shall be scrubbed into the dry, prepared surface. Care shall be taken to ensure that all surfaces receive a thorough, even coating and that no excess slurry is permitted to collect in pockets. The rate of progress in applying the slurry shall be limited so that slurry does not become dry before it is covered with fresh concrete.

C. Specialty Concrete: Follow manufacturer's written instructions for pre-wetting the bonding surface (if required) and bonding agent application.

3.06 APPLICATON - SPECIALTY CONCRETE/MORTAR

A. Mix, place, and cure in strict accordance with manufacturer's recommendations as given by the technical data sheets and other manufacturer recommendations.

B. Wet substrate thoroughly and then remove standing water. Scrub a slurry or neat patching mortar into substrate, filling pores and voids.

C. Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.

D. After each lift is placed, consolidate material and screed surface.

E. Where multiple lifts are used, score surface of lifts to provide a rough surface for application of subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.

F. Allow surfaces of lifts that are to remain exposed to become firm and then finish to match existing.

3.07 CURING PROCEDURE

A. Keep patching material moist for at least 3 days per manufacturers specifications. Cover with wet burlap and polyethylene well drained and maintained in a damp condition continuously. Fog spray concrete during the curing period as frequently as drying conditions may require.

B. During curing period, maintain concrete above 70°F for at least 3 days or above 50°F for at least 5 days.

C. Protect patching material against rapid drying and damage by rain and/or frost. Appearance of plastic shrinkage cracks may be cause for rejection.

D. Protect all repair work against damage and defacement during subsequent construction operations until final acceptance and full cure.

E. For patching and filling, comply with ACI 308, Chapter 5 and, if pre-mixed repair materials are used, the material manufacturer recommendations.

F. Crack Injection: Comply with manufacturer's written instructions, except as modified below:

1. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond, and clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
2. Place injection ports as recommended by the material manufacturer, spacing no farther apart than thickness of member being injected. Drill holes on angle so as to intersect the center of the crack at the center of the wall. Holes shall be 3/16 inch to 3/8 inch in diameter, staggered on opposite sides of the crack. Seal injection ports in place with capping adhesive.
3. Clean drill holes and injector ports of dust and debris by blowing out with oil-free compressed air and then flush with water from port to port.

4. Inject crack with the approved material, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports with non-staining clay when they extrude material. Cap injected ports and inject through adjacent ports until crack is filled. Inject the crack until all of the following are fulfilled:
   a. Grout enters crack or joint.
   b. Observable loss of grout returning from the crack is estimated to be less than 25% of volume of the grout being pumped.
   c. The grout injected reaches the next entry port.
   d. The grout has not extended for more than 5 ft along the crack or joint away from the grout hole.

5. After grout has set, remove injection ports, grind crack, patch and trowel to match existing surface.

3.08 FIELD QUALITY CONTROL

A. Technical Support

1. The Contractor shall arrange with the concrete repair material manufacturer or distributor to have the services of a competent field representative at the work site prior to any mixing of components to instruct the work crews in the proper mixing and application procedures. They shall remain at the job site after work commences and continue to instruct until they, the Contractor, and the Owner are satisfied that the crew has mastered the technique of installing the system successfully.
   a. The manufacturer's field representative must be fully qualified to perform the work and shall be subject to the approval of the Owner.

2. The Contractor shall be completely responsible for the expense of the services of the required manufacturer's field representative and the contract price shall include full compensation for all costs in connection therewith.

B. Contractor shall make provision to assist and coordinate monitoring of the work by the Owner and Consultant.

3.09 ADJUSTING AND CLEANING

A. Clean all exterior wall surfaces to remove dirt, stains, and marred surfaces from previous repairs and completed work activities. Final cleaning shall conform to previously approved test samples.

B. Remove all unused materials, residue, containers and waste in accordance with environmental regulations.

C. Remove and dispose of all materials used to protect surrounding areas and building surfaces, following completion of the work of this Section.

D. Repair, restore, or replace all materials, landscaping, interior finishes, and damages surfaces to the satisfaction of the Owner at no additional expense.

E. Provide daily cleaning of exterior wall and window surfaces.

END OF SECTION 03 93 00

SECTION 04 43 00

MASONRY REPAIR AND RESTORATION

PART 1 - GENERAL

1.01 SUMMARY

A. Provide labor, materials, equipment, and incidentals required to perform repair and restoration work at exterior masonry walls.

B. Work for this Section includes the following:

1. Removal and replacement of deteriorated masonry units.
2. Cutting and tuckpointing of damaged/deficient mortar joints.
3. Removal and installation of masonry for provision of through-wall flashings and restoration of embedded steel components.
4. Removal and replacement of areas of distressed masonry.
5. Provide masonry restoration anchors to secure masonry to back-up structure.
6. Saw-cut reglets in masonry as required to accept metal flashing.
7. Saw-cut existing expansion joints in masonry wall system to widen joint for sealant installation.
8. Restoration cleaning of wall surfaces.

C. All new materials are to be interfaced with, and integrated into, existing materials to provide completed work that is sound and weathertight.

1.02 UNIT PRICE – MEASUREMENT AND PAYMENT

A. Brick Removal and Replacement:

1. Basis of Measurement: By the individual unit and/or square foot (as indicated on the Bid From and Summary of Work), computed on the basis of rectangular solid shapes approximating the actual shape of brick removed and replaced, measured to the nearest foot.
2. Basis of Payment: Includes removals, preparation, replacement anchors, replacement masonry materials and cleaning.

B. Tuckpointing:

1. Basis of measurement: By the linear foot of tuckpointing.
2. Basis of Payment: Includes saw-cutting / removal of existing mortar, surface preparation, repair materials, and cleaning.

1.03 REFERENCES

A. All standards referenced are latest editions, unless otherwise indicated.

B. Building Code Requirements for Masonry Structures: ACI 530/ASCE 5/TMS 402

C. Specifications for Masonry Structures: ACI 530.1/ASCE 6/TMS 602

D. American Society for Testing and Materials (ASTM)

1. ASTM A 153: Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
2. ASTM A 525: Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.
3. ASTM C 62: Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).
4. ASTM C 67: Methods for Sampling and Testing Brick and Structural Clay Tile.
5. ASTM C 90: Load Bearing Concrete Masonry Units.
6. ASTM C144: Aggregate for Masonry Mortar.
7. ASTM C 150: Specification for Portland Cement.
8. ASTM C 207: Specification for Hydrated Lime for Masonry Purposes.
9. ASTM C 216: Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale).
10. ASTM C 270: Specification for Mortar for Unit Masonry.
11. ASTM C 387: Packaged, Dry, Combined materials, for Mortar and Concrete.
12. ASTM C 404: Aggregates for Masonry Grout.
13. ASTM C 476: Grout for Masonry.
14. ASTM C 1019: Method of Sampling and Testing Grout.
15. ASTM C 1072: Method for Measurement of Masonry Flexural Bond Strength.
16. ASTM C 1142: Ready-Mixed Mortar for Unit Masonry.
17. ASTM E 447: Test Methods for Compressive Strength of Masonry Prisms.
18. ASTM E 518: Test Method for Flexural Bond Strength of Masonry.

E. The Brick Industry Association (BIA): Technical Notes.

F. Indiana Limestone Institute of America Handbook

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product literature, performance data, and installation instructions for the specified materials.

B. Repair Procedures: Submit written procedures for the remedial work including materials, methods, and equipment that will be used.

C. Samples: Submit for verification purposes the following;

1. Provide at least ten (10) brick units to be used in replacement areas to illustrate color, texture and extremes of color range.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Hardware List: Submit a complete list of incidental materials to be provided under this Section.

F. Reports: Upon request, submit reports on mortar indicating conformance of component mortar materials to requirements of ASTM C 270.

1.05 QUALITY ASSURANCE

A. Contractor Qualifications: Not less than five (5) current years relevant successful experience with comparable projects and employing personnel skilled in the Work specified in this Section. The skilled person shall have at least five (5) years of experience and shall have successfully completed at least two (2) projects within the past three (3) years involving quantities and complexities similar to those required under this Section

B. Source of Materials: Obtain materials from a single source for each type required (face brick, cement, sand, etc.) to ensure quality, color, pattern, match, and texture.

C. Field Sample: Prior to starting full-scale installation of the Work, prepare the following sample applications. Do not proceed with field samples until all materials have been submitted and approved.

1. Clean two (2), 4 ft. by 4 ft. panels, unless otherwise directed by the Consultant, of wall to determine extent of cleaning necessary to remove efflorescence, dirt, plant fungi, etc. from masonry surfaces.
2. Repeat, using same or different cleaning methods up to 3 times, until acceptable.
3. Cut and point a 5 ft. by 5 ft. area of wall; cleaned and finished.
4. Rebuild a 5 ft. by 5 ft. area of wall, unless otherwise directed by the Consultant, cleaned and finished.
5. Acceptable field samples, and method of procedure, will become the standard for Work of this Section.

D. Pre-Installation Conference: Convene prior to commencing work with the Owner and Consultant to discuss sequencing and installation procedures.

1.06 DELIVERY, STORAGE AND HANDLING

A. Coordinate locations for on-site staging and storage areas with the Owner.

B. Package and neatly store materials in a manner that prevents surface damage or contamination, distortion, breakage or structural weakening. Replace any damaged materials.

1.07 PROJECT CONDITIONS

A. Protect elements surrounding the Work from damage or disfiguration.

B. Immediately remove stains, efflorescence, or other excess resulting from the Work.

C. Be prepared to immediately protect incomplete installations from damage by inclement weather.

D. Provide protection at open wall conditions due to delays in fabrication, shipment, and installation of the specified Work.

1.08 WARRANTY

A. Reference Section 01 78 00 – Project Closeout and Warranties.

PART 2 - PRODUCTS

2.01 GENERAL

A. Listed are primary products and materials for the specified restoration work. Provide all incidental items and materials required for completion of the Work in accordance with these documents.

2.02 MORTAR - SITE MIXED

A. NO PRE-MIXED OR BAGGED MASONRY CEMENT

B. Portland Cement: ASTM C 150, Type I or IA, white or natural color, low alkali (equivalent alkalis less than 0.6 percent). Only one brand and type portland cement shall be used for the Work unless prior written approval is obtained from the Consultant. Brands are subject to approval from the Consultant based on mortar color desired and obtainable by uses of the various brands readily available. Where white cement or nonstaining cement is required, the cement shall have not over 0.03 percent water soluble alkali in accordance with ASTM C 114.

C. Hydrated Lime: ASTM C 207, Type S

D. Mortar Aggregate: ASTM C 144 aggregate to match color and texture in original mortar, with no more than 50 parts per million chloride ions and free of organic contaminants. For joints narrower than 1/4 inch, use aggregate graded with 100 percent passing the No. 8 sieve and 95 percent passing the No. 16 sieve.

E. Water: Clean, potable, and free from deleterious acids, alkalis or organic materials.

F. Admixtures:

1. Admixtures such as air-entraining agents, accelerators, retardants, water repellent agents, antifreeze compounds, and other admixtures shall not be added to mortar unless specified.
2. Do not use admixtures containing more than 0.2% chloride ions.

3. Mortar Pigments: Mortar pigments shall only be used when an acceptable mortar can not be obtained by altering mix proportions and / or material types (such as different color sand and cement). Do not use pigments without written direction from the Consultant. Pigments shall conform to ASTM C 270 and C 979. Integral coloring material shall consist of inert, non-fading, finely ground, alkali-fast mineral oxides, made specifically for cement/lime mortars. Limit coloring additive so as to no exceed 10% of the weight of Portland cement. Do not use carbon black as a coloring additive.

G. Mortar Mixes:

1. Mortar for Brick and Stone: ASTM C 270, Type N using the Proportion Specification.
2. Tuckpointing: ASTM C 270, Type N using the Proportion Specification.
3. Mortar for Concrete Masonry: ASTM C 270, Type S using the Proportion Specification.
4. Mortar for Glass Unit Masonry: ASTM C 270, Type S using the Proportion Specification.

H. Mix Tests:

1. Testing of Mortar Mix: In accordance with ASTM C 780

2.03 GROUT

A. Provide grout that conforms to ASTM C 476.

B. Water: Clean, potable, and free from deleterious acids, alkalis or organic materials.

C. Bonding Agent: Slurry type.

D. Admixtures:

1. Admixtures such as coloring pigments, air-entraining agents, accelerators, retardants, water repellent agents, antifreeze compounds, and other admixtures shall not be added to grout unless specified.
2. Do not use admixtures containing more than 0.2% chloride ions.

E. Grout Mixes:

1. Proportion and mix grout in accordance with the requirements of ASTM C 476 grout.
2. Unless otherwise specified, mix grout to a consistency that has a slump between 8 and 11 inches.
3. Mix all cementitious materials and aggregates for a minimum of 5 minutes in a mechanical batch mixer with a sufficient amount of water to achieve specified slump.

F. Mix Tests:

1. Testing of Grout Mix: In accordance with ASTM C 1019.

2.04 MASONRY UNITS

A. Face Brick (Solid Masonry Units Made from Clay or Shale):

B. ASTM C 216, Grade SW, Type FBS , unless otherwise indicated.

C. Size, Texture and Color: To match adjacent, existing masonry units as approved by owner.

D. Properties:

1. Initial Rate of Absorption: 6 to 15 grams of water per minute per 30 square inches.
2. Efflorescence: Perform as described in ASTM C 67. Units shall have a rating of "Not Effloresced".

E. Use: Provide as needed for replacement of existing damaged units.

F. Provide special units for corners and other similar exposed applications.

G. Concrete Masonry Units (CMU):

1. ASTM C 90, Type I , unless otherwise indicated.
2. Size, Texture and Color: To match adjacent, existing masonry units. Provide samples for Owner approval.
3. Properties:
   a. Compressive Strength: Minimum 1,900 psi; gross area, average of 3 units.
   b. Water Absorption: Maximum of 13 lb/ft^3; average of 3 units.

4. Use: Provide as needed for replacement of existing damaged units.
5. Provide special units for corners and other similar exposed applications.

H. Common Brick: For fill in work, where not exposed, shall be a sound, hard burned clay or shale brick conforming to ASTM C 62, grade SW, of size to match existing.

2.05 REINFORCEMENT AND ANCHORAGE

A. All screws, bolts, nuts, washers, rivets, ties, and pins shall be hot-dipped galvanized steel (ASTM A 153, Class B), or Type 304 stainless steel.

B. Joint Reinforcement: Ladder type; steel wire, hot dip galvanized to ASTM A 641 after fabrication, 3/16 inch side rods and inch cross ties.

C. Strap Anchors: bent steel shape, stainless steel.

D. Wall Ties: Adjusted wall tie, with formed steel wire, minimum 3/16 inch diameter hot dip galvanized to ASTM A 153 B2 steel finish. Length as required to provide minimum 2 inch embedment in bed joint of outer masonry, and minimum 1/2 inch mortar cover.

E. Dovetail Anchors: Bent steel strap, stainless steel.

F. Masonry Anchor – Composite / Multi-wythe Construction: #9 gage, 2 inch wide hot dipped galvanized corrugated buck-type anchors, lengths to provide a 5/8 inch distance between the end of the anchor and the brick face.

2.06 RESTORATION ANCHORS

A. Type: Self-tapping, dry set, helical, 304 stainless steel, remedial wall tie. Provide anchors with minimum length and diameter as follows:

1. Concrete back up - 6.1 -inch length, asymmetrical tie; 10-8mm step-down
2. Masonry back up – 6.7 -inch length; 10mm
3. Lengths are subject to manufacturer's load testing of first installation.

B. Acceptable Manufacturer / Product:

1. BLOK-LOK Limited, Toronto, Ontario, Canada / Spira-Lok Wall Ties.
2. Helifix North America Corp., Concord, Ontario, Canada / DryFix Wall Ties.

C. Pull-Out Load: Minimum 350 lbs.

2.07 ACCESSORIES

A. Preformed Control Joints: Neoprene material. Provide with corner and tee accessories, cement fused joints.

B. Joint Filler: Closed cell polyethylene; oversized 50% to joint width; self-expanding; verify sized in field.

C. Weeps:

1. Type: Preformed rectangular, plastic flexible polyvinyl chloride designed for continuous exposure to weathering.
2. Size: minimum 1-1/2 inches in height, maximum height 1 head joint.
3. Color: As selected by Owner.
4. Acceptable Products:
   a. #342 Series Rectangular Plastic Weep Holes by Hohmann & Bernard, Inc.
   b. Quadro-Vent by Hohmann & Bernard, Inc.
   c. Approved equivalent.

2.08 CLEANING MATERIALS

A. Chemical Cleaning Agent: Mix agents according to manufacturer specifications.

B. Acceptable Products:

1. Prosoco Corp. / Enviro Klean EK Restoration Cleaner
   a. Primary Use: Provide as initial cleaner for stains at masonry and limestone.

2. Prosoco Corp. / Sure Klean 600
   a. Primary Use: Provide as an initial cleaner at previous mortar and brick replacement area.

3. Prosoco Corp. / 2010 All Surface Cleaner
   a. Primary Use: Provide as general cleaner for all exterior building surfaces.

PART 3 - EXECUTION

3.01 GENERAL

A. Examine each area of work and verify that existing conditions are acceptable for the specified installation procedures. Report, in writing, adverse conditions that could affect the performance of the Work within five calendar days. Absence of written notification will indicate the Contractor's acceptance of existing project conditions.

B. Measurements: Before ordering materials or performing work, obtain and verify all measurements at the building site. Exact measurements are the Contractor's responsibility.

C. Masonry workmanship shall comply with all applicable recommendations of the Brick Industry Association (BIA, formerly the Brick Institute of America), the Indiana Limestone Institute of America, and Masonry Structures ACI 530.1, except as modified below. Report any damage to new or existing flashings within the work area to the consultant, and provide for repairs by appropriately skilled tradesmen, at no cost to the Owner.

D. Hot weather (above 90^{o}F): Do not use mortar when masonry surface temperature is above 90^{o}F. Protect the masonry and mortar (mixed and individual components) from direct sunlight and exposure to wind, to avoid rapid evaporation of water in the mortar before, during, and after masonry construction. Mixed mortar must remain below 120^{o}F. When temperature is above 100^{o}F or 90^{o}F with winds, mist newly constructed masonry until damp, at least three (3) times a day, for at least three (3) days.

E. Cold Weather (below 40^{o}F): Do not work in average daily temperatures below 40^{o}F without providing cold weather protection as described in ACI 530 and outlined in the table below. Continue to operate heaters overnight with appropriate supervision. Do not use heaters that produce oily deposits on the masonry. If any oily deposits occur, consult with the Engineer to determine how best to remove oily deposits, and remove at the Contractor's expense.

Temp.	WORK IN PROGRESS			COMPLETED WORK
	Brick	Mortar	Assemblage	Assemblage
Above 40°F	No Requirements.	No Requirements.	No Requirements.	No Requirements.
40°F to 25°F	Remove visible ice.	Heat during mixing to between 40°F and 120°F. Maintain above freezing while in use.	No Requirements.	Protect masonry with a weather-resistive cover for 24 hours after construction. Completely cover masonry when temp. is less than 32°F.
25°F to 20°F	Remove visible ice.	Heat during mixing to between 40°F and 120°F. Maintain above freezing while in use.	Use heat sources on both sides of wall. Install wind breaks when velocity is over 15 mph.	Completely cover with insulated blanket for 24 hours after construction.
Below 20°F	Heat to above 20°F; remove visible ice.	Heat during mixing to between 40°F and 120°F. Maintain above freezing while in use.	Provide an enclosure and use heat sources to maintain temp. above 32°F within the enclosure.	Provide an enclosure and use heat sources to maintain temp. above 32°F within the enclosure.

F. Conduct all masonry work in a neat and workmanlike manner, to prevent staining any surface with mortar or other spills. Avoid dropping mortar on completed masonry work or other elements of the building. If mortar drops or spills, spot-clean immediately using a sponge and clean water.

G. Tolerances:

1. External corners and other conspicuous lines and levels: Maximum deviation from plumb or level ± 1/4 inch in any 10 ft section with a maximum cumulative amount of 3/8 inch in any one direction beyond 10 ft.
2. Variation from Level: Maximum 1/2 inch in 20 feet, or 3/4 inch in 40 feet or more.
3. Mortar bed joint thickness: 3/8 inch or match existing adjacent construction. Maximum deviation ± 1/16 inch
4. Mortar head joint thickness: 3/8 inch or match existing adjacent construction. Maximum deviation ± 1/16 inch
5. Vertical alignment of the center line of corresponding head joints in alternate courses when using other than stacked bond. Maximum deviation ± 1/4 inch

6. Vertical alignment of the center line of all head joints in total assemblage height when using other than stacked bond. Maximum deviation ± 1 inch

H. Preparation:

1. Clean masonry surfaces of any loose or deleterious material which could prevent adhesion or otherwise impair performance of installed materials.
2. Carefully remove and store fixtures.

I. Manufacturer's Recommendations: Comply with the manufacturer's written approved installation instructions and with any governing regulations and industry standards applicable to the work.

3.02 MORTAR MIXING

A. Thoroughly mix mortar ingredients in accordance with ASTM C 270 in quantities needed for immediate use.

B. Measure cementitious and aggregate material in a dry condition by volume. Do not measure by shovel; use a known volume measure (i.e. box or bucket).

C. Maintain sand uniformly damp immediately before the mixing process.

D. Do not use anti-freeze compounds to lower the freezing point of mortar.

E. Mortar Mixing Procedure:

1. General
   a. Mix all cementitious materials and aggregates between 3 and 5 minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency.
   b. Unless acceptable, do not hand mix mortar.
   c. Maintain workability by remixing or retempering. Discard all mortar which has begun to stiffen or is not used within 2-1/2 hours after initial mixing.

2. Tuckpointing
   a. Prehydrate to reduce excess shrinkage.
   b. Mix materials in a clean mechanical batch mixer.
   c. Add only enough clean water to produce a consistency which will retain its shape when formed into a ball (about 2 total required mixing water).
   d. Allow mortar to stand in this dampened condition for approximately 30 to 45 minutes.
      1) Add the balance of the mixing water to bring mortar to the proper workable consistency (somewhat drier than conventional masonry mortars).
      2) Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material. Discard any mortar not used within the 30 minutes.

3.03 MASONRY UNITS

A. General:

1. Remove existing masonry, as required to complete the Work. Prior to starting Work, verify locations with the Owner.
2. Construction Tolerances, Corners, and Recess: Match existing wall conditions.
3. Provide shoring and support, as required, prior to removing existing masonry units.
4. Saw cut mortar joints of masonry units from existing walls with motor-driven saw designed to cut masonry with clean, sharp, unchipped edges; only after test cuts determine no damage to masonry units will result].
5. Cut new masonry units as required to fit adjoining work neatly.
6. Use full units without cutting wherever possible.
7. Avoid the use of less-than-half-size units at corners, jambs, and at other locations.
8. Install masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line.
9. Pre-wet masonry units, as needed, in accordance with ACI 530.
10. Recondition existing support steel prior to installing new units, in accordance with Section 09900.
11. Seal all wall penetrations (drain pipes, lightning cables, etc.) with elastomeric sealant specified in Section 07920 – Joint Sealants.

B. Mortar Bedding and Jointing:

1. Provide new wire ties to replace damaged ties.
2. Lay new units with completely filled bed and head joints. Butter ends with sufficient mortar to fill head joints and lay into place. Do not slush head joints. Tooth new units into existing masonry work, to match existing bonding patterns.
3. Spaces between masonry units and backup materials are to remain free and clear of mortar.
4. Tuckpoint head joints and top joints where new work adjoins existing masonry work in accordance with this Section.
5. Joint Widths: To match existing.
6. Exposed Joints: Prior to initial set, and when "thumbprint" hard, tool mortar joints to match existing brickwork mortar. At caulked joints, rake out mortar to the required depth to be finished with sealant.
7. Concealed Joints: Cut flush joints in surfaces to be concealed or covered by other construction.
8. Collar joints: At existing collar joints, reconstruct after each course of new masonry is laid, filling the vertical joint between wythes solid with mortar.

C. Establish lines, levels, and coursing indicated. Protect from displacement.

D. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

E. Brick Units:

1. Bond: match existing
2. Mortar Joints: Concave.
3. Coursing:
   a. Vertically: match existing.
   b. Horizontally: match existing.

F. Concrete Masonry Units (CMU):

1. Bond: Running.
2. Mortar Joints: Concave.

G. PLACING AND BONDING

1. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
2. Lay hollow masonry units with face shell bedding on head and bed joints.
3. Do not lay mortar bed more than 2 ft ahead of work.
4. Do not furrow bed joints.
5. Completely butter the ends and head of each unit with mortar and shove the unit into place so that mortar squeezes out the top of the head joint and bed joint. Do not slush head joints.
6. At cavity wall sections, cut off and scoop out the mortar that extrudes from bed and head joints on outer and inner faces of the wythe.
7. Do not disturb, tap, shove or push units once they are laid in their final position. Where adjustment must be made, remove mortar and replace.
8. Tooth masonry at intersections and external corners.
9. Perform job site cutting of masonry units with proper masonry saw to provide straight, clean, unchipped edges. Prevent broken masonry unit corner or edges. Do not break masonry units with a hammer.
10. Strike exterior of mortar joints flush during laying. When mortar is thumb print hard on exposed surfaces, tool joints concave with a cylindrical pointing tool slightly larger than the masonry joint to compact the mortar thoroughly.
11. Slightly bevel bed joint mortar away from the cavity space before placing the unit to minimize mortar protrusions into any cavity space intended to be free of mortar. Back parge or strike mortar extrusions in the cavity space.
12. Above flashing, provide weeps at every third head joints.
13. Isolate top joint of masonry walls from horizontal structural framing members and slabs or decks with compressible joint filler.

H. WALL CAVITY BEHIND VENEER

1. Do not permit mortar to drop or accumulate into cavity air space or to plug weeps.
2. Provide clean-out every third unit of the bottom course to remove any mortar droppings in the cavity space, clean mortar at openings as necessary prior to the mortar hardening.
3. Build outer wythe to permit installation of cavity insulation.

I. REINFORCEMENT AND ANCHORAGE

1. General: All masonry reinforcement and anchors should be completely bedded in mortar. Direct masonry unit-to-anchor contact is not permitted.
2. Install horizontal joint reinforcement 16 inches on center.
3. Place masonry joint reinforcement in first horizontal joint above and below openings. Extend minimum 16 inches each side of opening.
4. Place joint reinforcement continuous in first and second joint below top of walls.
5. Lap joint reinforcement ends minimum 6 inches.
6. Install wall ties in masonry back-up for bonding veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place at maximum 3 inches on center each way around perimeter of openings, within 12 inches of openings.
7. Reinforce concrete masonry unit joint corners and intersections with strap anchors 16 inches on center.

J. EXPANSION AND CONTROL JOINTS

1. Do not continue horizontal joint reinforcement through expansion and control joints.
2. Construct expansion and control joints in accordance with Section 07920 – Joint Sealants for proper sealant performance.
3. All expansion and control joints should be clear, free of mortar and other construction materials.

3.04 GROUT INSTALLATION

A. Remove masonry protrusions extending 1/2 inch or greater into cells or cavities to be grouted.

B. Place grout within a 1/2 hour from introducing water into the mixture and prior to initial set.

C. Confine grout to the areas indicated on the Drawings. Use materials to confine grout that permits bond between masonry units and mortar.

D. Do not exceed the maximum grout pour height given in ACI 530.1/ASCE 5/TMS 402 Table 7.

E. Place grout lifts not exceeding 5 feet.

F. Consolidate grout at the time of placement.

1. Consolidate grout pours 12 inches or less in height by mechanical vibration or by paddling.
2. Consolidate pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

G. Provide horizontal construction joints between grout pours, with the grout stopping a minimum 1/2 inch below mortar joint, except at the top of the wall.

H. Do not displace reinforcement while placing grout.

3.05 REPOINTING EXISTING MASONRY

A. General: Tuckpoint mortar joints containing static cracks, deterioration, holes or voids. New bedding and pointing mortar mix should not have a compressive strength that exceeds existing mortar or masonry materials.

B. Joint Preparation:

1. Clean existing masonry surfaces to remove dirt, efflorescence, plant fungi, etc. prior to tuckpointing work.
2. Rake out mortar from joints to depths equal to 2-1/2 times their widths but not less than 3/4 inch by use of hand tools and/or motor driven saw designed to cut masonry with clean, sharp, unchipped edges; only after test cuts determine no damage to masonry units will result].
3. Remove mortar from masonry surfaces within raked-out joints to provide 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.

C. 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 pointing mortar in minimum 3 layers with each of first and second layers filling approximately 2/3 of joint depth and third layer the remaining 1/3. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing brick 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.
3. 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. Cure mortar by maintaining in a damp condition for not less than 72 hours. Where repointing work precedes cleaning of existing masonry, allow mortar to cure not less than 14 days before beginning cleaning work.

3.06 MASONRY FLASHINGS

A. At existing flashing, remove masonry at flashings locations indicated on Drawings as required to complete the work.

B. Install new flashing system in accordance with Section 07620 – Sheet Metal Flashings and Trim.

C. Install new masonry units to match and align with existing units, joints and coursing true and level, faces plumb and in plane.

D. Install weeps in veneer at 24 inches o.c. horizontally directly above flashing.

3.07 SAW-CUTTING REGLETS AND EXPANSION JOINTS

A. Perform all saw-cutting of masonry using motor driven saw designed to cut masonry with clean, sharp, unchipped edges. Replace any masonry units which become damaged. Perform test cuts as directed by the Consultant to verify no damage to masonry units will result.

B. After saw-cutting, brush, vacuum, or flush joints to remove dirt and loose debris.

C. At cracked masonry scheduled to be “routed and sealed”, saw-cut existing masonry joints as required to provide a minimum joint width of 1/4 inch, or as recommended by the sealant manufacturer.

D. At masonry expansion joints less than 3/8 inch wide, saw-cut joints full depth to provide minimum 1/2 inch width.

E. At reglets, saw-cut masonry to receive metal flashing, as indicated on the Drawings.

3.08 REMEDIAL WALL TIES

A. Fastener spacing / layout will be determined through field verification with Consultant for each location indicated on Drawings.

B. At masonry, all fasteners shall be installed in mortar T-joints, unless directed otherwise by the Consultant.

C. Provide pilot entry hole approximately into the face and substrate materials using a rotary percussion drill (3-jaw chuck type).

D. Drive the helical wall tie into position by manufacturer’s setting tool mounted on an electric hammer drill (S.D.S. type). Setting tool shall recess the tie a minimum 3/8 inch into the face of the masonry.

E. Patch all penetrations with an approved, compatible material, aesthetically finished to match adjacent surfaces.

3.09 MASONRY CLEANING

A. General:

1. Clean existing masonry in areas of repair work to ensure positive mortar bond.
2. Cleaning methods must be sufficiently flexible to permit adjustment of procedures and application speed for maximum effectiveness. Perform small test samples for each type of stain, starting with the least aggressive procedure, to determine effectiveness and prevent substrate damage.

3. Approved cleaning methods consist of water and light abrasion with hand tools. Stains that may require more aggressive cleaning procedures, consisting of power tools or chemicals, must be approved by the Consultant and demonstrated by test samples.
4. When cleaning masonry, mask lower areas as required to prevent loosened stains from soiling other surfaces, or keep the lower areas saturated with water to prevent absorption of dirty run off. Remove all stains as soon as possible. Do not smear wet stains by wiping. Soak up wet stains with absorbent materials (cotton cloths).

B. Saturate masonry, and all other porous materials, with clean water prior to proceeding with cleaning work.

C. Pre-treat heavy stains and efflorescence staining with the least aggressive cleaning material that will remove the staining.

D. After pre-treatment, provide a general cleaning of all masonry areas using a diluted detergent.

E. Provide a complete and thorough wash-down of all masonry, and other wall system components, working from the top down.

F. Chemical and High Pressure Steam Cleaning: for concrete, brick masonry, or stone masonry surfaces at specified locations to remove existing staining and leave surface with uniform color and texture.

G. New Mortar:

1. After new mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter using stiff nylon brushes and clean water that is spray applied at low pressure.
2. Remove surplus mortar from the faces of masonry units at the time joints are struck or tooled. Mortar should be removed while it is still plastic using a clean, wet sponge or scrub brush having stiff bristles.
3. Do not use harsh cleaners, acids, abrasives to clean masonry surfaces. If a chemical cleaning agent is required, obtain initial approval from both the masonry unit manufacturer and Consultant.
4. Final mortar removal is to be accomplished with a clean wet sponge or cloth. Rinse sponges or clothes frequently in clean water to remove abrasive particles. Allow any remaining film on the masonry to dry to a powder.

3.10 FIELD QUALITY CONTROL

A. Contractor shall maintain or exceed levels of workmanship and material acceptability in regard to surface preparation, cleaning, and coating application as established by mock-up/test samples.

B. Contractor shall employ trained, skilled and experienced tradesmen for all phases of the Work.

C. Contractor shall make provision to assist and coordinate monitoring of the Work by the Manufacturer and Owner Representatives.

3.11 ADJUSTING AND CLEANING

A. Clean site of all unused materials, residues, and waste in accordance with environmental regulations.

B. Remove and dispose of all materials used to protect surrounding areas and building surfaces, following completion of the Work of this Section.

C. Repair, restore, or replace all materials, landscaping, interior finishes, and damaged surfaces to the satisfaction of the Owner at no additional expense.

END OF SECTION 04 43 00

SECTION 05 12 20

STRUCTURAL STEEL FOR RESTORATION

PART 1 - GENERAL

1.01 SUMMARY

A. Provide labor, material, and equipment to provide structural steel components as specified in this Section for Contingency only.

B. Work for this Sections includes the following:

1. Fabrication and installation of new:
   a. steel lintels
   b. steel plates

C. Work of this Section shall conform to the AISC Code of Standard Practice tolerances.

1.02 REFERENCES

A. The listed Codes, Specifications and Standards shall be used in the completion of the work contained in this Section of the Specification. References are latest editions, unless otherwise indicated.

B. American Institute of Steel Construction, Inc. (AISC):

1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.

C. American Welding Society (AWS):

1. D1.1, Structural Welding Code - Steel (ANSI/AWS D1.1)

D. American Society for Testing and Materials (ASTM) Standard:

1. ASTM A 36: Structural Steel.
2. ASTM A 500: Cold-formed Welded and Seamless Carbon Structural Tubing in Rounds and Shapes.
3. ASTM A 123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A 325: High Strength Bolts for Structural Steel Joints.
5. ASTM A 307: Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
6. ASTM A 490: Heat-treated Structural Steel Bolts, 150 ksi Minimum Tensile Strength.
7. ASTM A 572: High-strength, Low-alloy Columbium-Vanadium Steels of Structural Quality.

8. ASTM A 992: Structural Steel Shapes.

E. The Society for Protective Coatings (SSPC):

1. SSPC: Steel Structures Painting Manual.

1.03 SUBMITTALS

A. Submit detailed and coordinated shop drawings of all structural steel for review prior to the start of fabrication and erection.

B. Provide mill test reports indicating ASTM grade, minimum yield strength and minimum tensile strength for all components.

C. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests for the joints specified in these documents.

1.04 QUALITY ASSURANCE:

A. Contractor Qualifications: Not less than five (5) current years relevant successful experience with comparable projects and employing personnel skilled in the Work specified in this Section. The skilled person shall have at least five (5) years of experience and shall have successfully completed at least two (2) projects within the past three (3) years involving quantities and complexities similar to those required under this Section

B. Source of Materials: Obtain materials from a single source for each type required, to ensure uniform quality, color, match, and texture.

C. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

1. If recertification of welders is required, retesting shall be Contractor's responsibility.

D. Pre-Installation Conference: Convene prior to commencing work with the Owner and Consultant to discuss sequencing and installation procedures.

1.05 DELIVERY, STORAGE AND HANDLING

A. Storage of Materials: Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

B. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Replace permanently distorted and damaged members and structures.

PART 2 - PRODUCTS

2.01 GENERAL

A. Listed are the products and materials for the specified work. Provide all incidental items and materials required to complete the Work in accordance with these documents.

2.02 MATERIALS

A. Structural Steel:

1. Structural steel sections: ASTM A 36
2. Finish:
   a. Steel Angle: Hot dip galvanized, in accordance with ASTM A 123, , .

3. Connections: Weld in accordance with AWS D1.1, AWS A5.1 and/or Bolt in accordance with AISC Specifications.
4. Fabrication: Provide all plates and shapes neatly sheared or saw-cut to length and width requirements, free from torn edges or burrs.

B. Miscellaneous Components:

1. Welding electrodes: AWS A5.1, E7018.
2. Fasteners:
   a. 1/2", diameter A325 Type 2 high-strength bolt with A563 nut, and F436 washer.]
   b. Acceptable product: Hilti

3. Grout: Non-shrink, non-metallic grout which conforms to Corps of Engineers CRD C-621.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Measurements: Before ordering materials or performing work, obtain and verify all measurements at the building site. The Contractor is responsible for the correctness of measurements and agrees to satisfactorily correct any work which does not fit, or furnish new work, if necessary. Exact measurements are the Contractor's responsibility.

B. Existing Conditions:

1. Upon removal of the existing masonry veneer, inspect the existing steel lintel for signs of severe corrosion or damage.

C. Protect adjacent surfaces and finishes against damage from Work performed in this Section.

3.02 EXECUTION:

A. General: Steel shall be fabricated and erected to AISC Code of Standard Practice tolerances.

B. Attachment of New Steel:

1. Metal parts to be welded shall be clean and free of all corrosion, dirt, oil, grease, paint or any other material detrimental to the quality of the weld. The fit of the material shall be accurate to prevent undercutting of base metal.
   a. All field welds are to be reviewed by the Consultant for size and quality.
   b. Field burning of bolt holes is not permitted.

C. Metal Re-Finish and Touch-Up

1. Prior to touch-up, all areas to be , finish coated shall be thoroughly cleaned of rust, dirt, oil, grease, and weld slag.
2. Surfaces to be refinished shall include, but are not limited to, abrasions, scars, cut edges and welds.
3. Touch-up coating shall extend a minimum of 2" onto undamaged finish.
4. Coating shall be uniformly applied to dry surfaces to a dry film thickness of no less than 2 mils.

3.03 FIELD QUALITY CONTROL

A. Contractor shall employ trained, skilled and experienced tradesmen for all phases of the work.

B. Contractor shall make provision to assist and coordinate monitoring of the work by the Manufacturer and Owner.

3.04 ADJUSTING AND CLEANING

A. Clean site of all unused materials and waste in accordance with environmental regulations.

B. Remove and dispose of all materials used to protect surrounding areas and building surfaces, following completion of the work of this section.

C. Repair, restore, or replace all materials, landscaping, interior finishes, and surfaces damaged by the Work to the satisfaction of the Owner at no additional expense.

END OF SECTION 05 12 20

SECTION 06 10 00

ROUGH CARPENTRY FOR ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Furnish all labor, materials, equipment and supervision to install/replace the following:
   a. Wood blocking.
   b. Wood curbing.
   c. Plywood Sheathing.

1.02 REFERENCES

A. ALSC (American Lumber Standards Committee) - Softwood Lumber Standards.

B. NFPA (National Forest Products Association).

C. APA (American Plywood Association)

D. AWPA (American Wood Preservers Association) C1 – All Timber Products Preservative Treatment by Pressure Process.

1.03 DELIVERY, STORAGE AND HANDLING

A. Inspect materials delivered to the site for evidence of contact with moisture. Reject delivery of materials with stained or wet wrappers or torn covers. Packaging labels must be readable, identify the material, and indicate conformance with the reference standard applicable to the material.

B. Store all lumber as follows:

1. Do not expose materials to moisture of any form.
2. When out-of-doors, store on clean raised platforms at least four inches above the ground surface.
3. Completely cover all lumber with weatherproof covers to protect from weather and moisture.
4. Arrange covers to allow venting; do not allow covers to extend onto the ground. Do not use polyethylene or other non-breathing cover materials.
5. Factory applied plastic wrap is not an acceptable weatherproof cover. Rooftop storage of lumber is not permitted except for materials intended for installation that same day.

1.04 PROJECT CONDITIONS

A. Prior to ordering materials, or doing any work, verify at the site all dimensions, details, and conditions which may affect the work. No allowance for additional compensation will be considered for discrepancies between dimensions indicated in the specifications and drawings and actual field dimensions, or for the Contractor's failure to comply with this requirement.

PART 2 - PRODUCTS

2.01 LUMBER MATERIALS

A. Wood Nailers/Blocking and Curbs

1. Southern Yellow Pine or Hem Fir; No. 2 grade; free from warping and visible decay.

B. Plywood Sheathing

1. Exposure1, Grade C-D, thickness 3/4" minimum.

PART 3 - EXECUTION

3.01 CARPENTRY

A. Roof Edge

1. Mechanically attach wood blocking. Blocking thickness: Equal to final insulation thickness. Width: Six (6) inches nominal.
2. Wood securement at roof perimeters shall be in accordance with FM Loss Prevention Data Bulletin I-49.
3. Fasteners shall be installed in two staggered rows. Spacing in any one row shall not exceed 24 inches on-center. Within eight (8) feet of outside corners spacing shall not exceed 12 inches in any one row.
4. Offset blocking layers 12 inches; weave corners.
5. Install wood cants as required to comply with fascia systems. Nail to underlying blocking 12 inches O.C.

B. Parapet Walls

1. Replace rotted blocking as required.
2. Mechanically attach new wood blocking to top surface of parapet wall construction.
3. Wood securement at roof perimeters shall be in accordance with FM Loss Prevention Data Bulletin I-49.
4. Fasteners shall be installed in two staggered rows. Spacing in any one row shall not exceed 24 inches. Within eight (8) feet of outside corners spacing shall not exceed 12 inches in any one row.

5. Offset blocking layers 12 inches; weave corners.
6. Install new plywood sheathing along interior face of parapet wall.

C. Wood Curbs

1. Mechanically attach additional wood blocking on top of the curb to raise final curb height eight (8) inches minimum above new roofing plane. Blocking shall be flush with outside curb surface.

D. Metal Curb Flashings

1. Raise curb.
2. Clean flange.
3. Replace rotted blocking.
4. Mechanically attach wood blocking to existing blocking. Blocking thickness around curb: Equal to final insulation thickness. Width: Same as existing, or sufficient to accommodate unit.
5. Fasteners shall be installed in two staggered rows. Spacing in any one row shall not exceed 24 inches on-center.
6. Offset blocking layers 12 inches; weave corners.

E. Expansion Joint

1. Install wood blocking for a raised expansion joint at designated locations. Vertical height of blocking shall be a minimum of eight (8) inches above the finished roof surface.
2. The vertical blocking shall be attached to a horizontal nailer, 2 X 6 minimum, equal to the insulation thickness. The wood curb assembly shall be mechanically attached to the metal decking and/or existing wood blocking.
3. Expansion joint curb to maintain a minimum of two (2) inches between vertical blocking for expansion.
4. The vertical blocking shall be tapered down at the perimeter edge.

F. Area Divider

1. Install wood blocking for a raised area divider at designated locations. Vertical height of blocking shall be a minimum of eight (8) inches above off the finished roof surface.
2. The vertical blocking shall be attached to a horizontal nailer, 2” X 6” minimum, equal to the insulation thickness. The curb assembly shall be mechanically attached to the metal decking and/or existing wood nailer.
3. The vertical blocking shall be tapered down at the perimeter edge.

END OF SECTION 06 10 00

SECTION 07 19 00

WATER REPELLENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide labor, materials, equipment, and incidentals required to perform the specified scope of work.

B. Work for this Section includes the following:

1. Apply a clear, penetrating sealer to exterior surfaces as shown on drawings. Performance of this Work is initially subject to on-site mockup testing of designated sample locations.
2. Application of sealer shall only be to surfaces which are structurally sound, and have been properly prepared in accordance with the manufacturer's requirements. All preparatory work shall include any masonry repairs, building sealant installation, elastomeric coating applications, cleaning, etc. Work shall be approved by the Manufacturer's Representative and Consultant prior to application of sealer.
3. Provide the necessary protection for all materials that may be contaminated or damaged by overspray of the water repellent, including metal, glass, landscaping, etc.

C. All new materials are to be interfaced with, and integrated into, existing materials to provide completed work that is weathertight and aesthetically acceptable by the Owner.

1.02 REFERENCES

A. References are latest editions, unless otherwise indicated.

B. American Society for Testing and Materials (ASTM):

1. ASTM D 1653: Standard Test Method for Water Vapor Transmission of Organic Coating Films.
2. ASTM D 5703: Standard Practice for Preparatory Surface Cleaning for Clay Brick Masonry.
3. ASTM E 514: Standard Test Method for Water Penetration and Leakage through Masonry.

1.03 SUBMITTALS

A. Product Data:

1. Sealer manufacturer's specifications, recommendations, and cleaning and installation instructions.
2. Published data or certified test laboratory report that each of the materials complies with requirements and is intended for application shown.
3. Sample warranty and associated application report forms required by the manufacturer for warranty purposes.

B. Proposed methods to protect adjacent building components, landscaping, etc.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: Not less than five (5) current years relevant successful experience with comparable projects and employing personnel skilled in the Work specified in this Section. The skilled person shall have at least five (5) years of experience and shall have successfully completed at least two (2) projects within the past three (3) years involving quantities and complexities similar to those required under this Section.

B. Manufacturer Qualifications: Not less than twenty (20) years successful experience with the production and sales of exterior masonry sealers intended for Work of this Section.

C. Source of Materials: Obtain materials from a single source for each type required to ensure quality, color, pattern, and texture match.

D. Field Samples:

1. Prior to starting Work, and in conjunction with the Owner and Consultant, select a minimum of two (2) separate, full-sized, erected wall areas which are representative of the total project for sample cleaning. Apply approved water repellent to one half of field constructed mock-up panels before proceeding with installation.
2. Manufacturer's representative and Consultant are to be notified and present during the preparation and application of the sealer systems to test sample areas.
3. Cleaning methods and application of sealer system are to reflect the proposed procedures and workmanship expected during full-scale application.
4. Upon completion of and drying / curing of each test area, the Contractor shall perform surface porosity testing of the treated wall area(s) with Rilem tubes, as specified in the Field Quality control portion of this Section. The Contractor, Manufacturer, Owner, and Consultant must be present at the time of the testing. The results of the testing will be used to evaluate the preparation requirements and the type / concentration of the sealer(s) that are effective in reducing water penetration, with minimal discoloration of substrate, and proper penetration characteristics prior to full-scale application.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site with packages intact and with labels identifying manufacturer, product name and lot numbers when appropriate.

B. Store approved materials in accordance with manufacturer's instructions. As a minimum, comply with the following:

1. Store all materials off the ground under watertight cover and away from sweating walls, damp surfaces, and freezing temperatures.
2. Immediately remove damaged or deteriorated materials from the job site.
3. Use necessary means to ensure safe storage and use of materials, as well as prompt and safe disposal of waste.

C. Personnel shall be warned against prolonged breathing of vapors and contact of materials with skin or eyes. Keep products away from heat, sparks, and flame. Do not allow uses of spark producing equipment, such as switches, appliances, etc., during application and until vapors are gone. Post “No Smoking” signs.

1.06 PROJECT CONDITIONS

A. Comply with manufacturer's requirements for environmental conditions under which systems can be applied.

B. Do not apply sealer in areas where dust is being generated.

C. Do not apply sealer in snow, rain, fog, or on damp/wet surfaces.

D. Sealer application may be continued during inclement weather if areas and surfaces are enclosed and within temperature limits specified by the manufacturer during application and drying periods.

E. Protect elements surrounding the Work from damage or disfiguration.

PART 2 - PRODUCTS

2.01 GENERAL

A. Acceptable water repellent products listed are for guideline purposes only. Repellent performance is based on many factors and as such, field testing of several materials may be required before an approved product is determined. Reference the Field Testing requirements described in Part 1 of this Section.

B. Provide all incidental items and materials required for completion of the Work in accordance with these documents and manufacturer requirements.

C. Comparable materials by other manufacturers will be considered when requested in writing prior to bidding. No substitute will be considered approved unless confirmed in writing by the Consultant.

2.02 MATERIALS

A. Siloxane-Blend Penetrating Water Repellent Sealer.

1. Water Vapor Transmission: Minimum of 90% compared to untreated surfaces when tested to ASTM E 96.
2. Water Penetration / Leakage: Minimum 100% compared to untreated surfaces when tested to ASTM E 514.
3. Reduction of Water Absorption: Minimum 85% compared to untreated surfaces when tested to ASTM C 97.
4. Resistance to Accelerated Weathering: No loss in repellency after 2,500 hours, ASTM G 154.
5. Apply to clay brick, limestone and precast concrete.
   a. Acceptable Products:
      1) MasterProtect H 177
      2) ProSoCo, Inc. - Siloxane PD
      3) Protectosil / Chemtrete - 40 VOC

B. Cleaners:

1. Materials used for cleaning and water repellent treatments shall be approved by the sealer manufacturer to ensure compatibility.
2. Pre-mixed, commercially available cleaner, specially prepared for use with spray equipment and cleaning existing materials.

C. Miscellaneous Materials:

1. Tarps or polyethylene sheeting for protection of existing landscaping and building surfaces.
2. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film forming, strippable masking material for protecting glass, metal and polished stone surfaces from damaging effect of cleaners.
   a. Diedrich Technologies, Inc. / Diedrich Acid Guard
   b. ProSoCo, Inc. / Strippable Masking WB

3. Masking tape: Pressure sensitive adhesive paper tape.
4. Shop Cloths: Use shop cloths or clean, lint-free rags for cleaning operations.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The Contractor shall be responsible for inspecting the substrate and verifying that no conditions are present which may prevent or otherwise interfere with application of the proposed water repellent system or with obtaining the required manufacturer's warranty.

B. Any adverse conditions which might affect the performance of the water repellent must be reported in writing within three calendar days of identification. Absence of such notification shall constitute the Contractor's verification that existing conditions will allow application of the system in accordance with these documents, as well as the manufacturer's requirements and recommendations.

3.02 PREPARATION

A. General:

1. Repair, patch, and fill all cracks, voids, defects, and damaged areas of existing substrate materials. Allow repair materials to cure completely before application of the product.
2. Ensure that all required sealant and elastomeric coating work has been completed prior to water repellent application.
3. Remove old paint, caulking, sealers, roofing tar, and any other materials that may inhibit penetration of the water repellent product.
4. Clean all substrate surfaces. Provide approved cleaning methods to remove dirt, oil, dust, grease, tar, plant fungi, and other foreign material.
5. Treat any apparent alkali or efflorescence with proper neutralizing compound recommended by the water repellent manufacturer.

B. Cleaning:

1. Thoroughly pre-wet surfaces to be cleaned.
2. Mix cleaning solution in accordance with the manufacturer's instructions.
3. Using a densely packed, soft fibered washing brush, apply the diluted cleaning solution freely to the building surface.
4. Allow cleaning solution to remain on building surfaces for a period of approximately one to three minutes, but not to the point that it dries.
5. Rinse surfaces thoroughly with fresh water, removing all cleaning compound, loose or excess mortar, residual sealant, or other materials detrimental to the sealer application.
6. If surface dirt/stains remain, repeat cleaning procedures, or use an alternate surface cleaner as recommended by the water repellent manufacturer.

3.03 APPLICATION

A. Verify that substrate surfaces have been cleaned and are dry before proceeding.

B. Apply product in accordance with manufacturer’s written instructions and in accordance with the application procedures determined from approved field samples.

C. Consult manufacturer’s written instructions for information on application equipment to be used and precautions to be taken with the specified products.

D. Do not dilute or alter product, unless otherwise specified by the manufacturer.

E. In general, application shall consist of the following:

1. Saturate relatively small sections with the water repellent at coverage rates determined by approved field samples, and recommended by the manufacturer. Apply the product from the bottom-up. Always flood material with a 4 to 8 inch rundown onto surfaces to assure maximum saturation into substrate.
2. Allow the sealer to be absorbed into the wall for 5 to 15 minutes, depending upon drying conditions.
3. If required, apply a second coating of sealer to achieve proper coverage and penetration.
4. Immediately wipe-off and clean water repellent from wall and surrounding surfaces with a window squeegee and dry, clean, lint-free cloths.

3.04 FIELD QUALITY CONTROL

A. Contractor shall maintain or exceed levels of workmanship and material acceptability in regard to surface preparation, cleaning, and application as established by field samples.

B. Contractor shall make provision to assist and coordinate inspections of the Work by the Manufacturer and the Owner.

3.05 ADJUSTING AND CLEANING

A. Clean site of all unused water repellents, residues, rinse water, wastes, and effluents in accordance with environmental regulations.

B. Remove and dispose of all materials used to protect surrounding areas and non-masonry surfaces, following completion of the Work of this Section.

C. Repair, restore, or replace all materials, landscaping, and non-masonry surfaces damaged by exposure to sealer product to the satisfaction of the Owner at no additional expense.

END OF SECTION 07 19 00

SECTION 07 22 00

ROOF AND DECK INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: furnish all labor, materials and supervision to install in accordance with the Contract Documents all items listed, but not limited to:

1. Installation of insulation course(s) to specified substrate.
2. Installation of replacement insulation materials.
3. Installation of tapered insulation courses to specified substrate.
4. Installation of cover board top layer to the specified substrate.

1.02 PERFORMANCE REQUIREMENTS

A. Polyisocyanurate insulation products shall meet or exceed the criteria of ASTM C1289-02 Industry Standards.

1. "LTTR" values are to be determined in accordance with CAN/ULC S770 test methods.
2. "LTTR" values to be based on 15 year time weighted averages.

1.03 SUBMITTALS

A. Manufacturer's latest descriptive literature, installation instructions and procedures to be followed during installation.

B. Letters from manufacturers or published information verifying compatibility with additional materials specified within this Section as well as substrate materials to which they will be installed.

1.04 QUALITY ASSURANCE

A. New insulation material shall have accurate dimensions and sufficient structural stability to conform to the surfaces of the roof, cants, curbs, pipes and joints.

B. Joints between boards shall be tight, except at junctions with all vertical surfaces and sumps, where 1/2 inch clearance shall be maintained.

C. Lay no more insulation than can be completely covered by specified waterproofing membrane during the same day.

D. Insulation that becomes wet during or after installation shall be removed and replaced with dry insulation. If the roof membrane has already been applied over such wet insulation, then the roofing membrane shall also be replaced.

E. All such replacement work shall be at no additional charge to the Owner.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site with packages and labels intact; identifying manufacturer, product name and lot numbers when appropriate.

B. Store materials:

1. In accordance with applicable manufacturer's recommendations and Material Safety Data Sheets.
2. In a suitable and designated area at the job site.
3. Support materials off the ground and cover with materials that create a weatherproof barrier. Factory applied plastic wrap is not an acceptable weather proof cover.
4. Protect insulation from the weather at all times.

C. The designated staging area shall be restricted to storage of materials and related equipment.

1.06 PROJECT CONDITIONS

A. Environmental Conditions:

1. Do not proceed with work under threatening or during unfavorable weather conditions.
2. If work is interrupted by weather, provide the necessary protection for newly installed materials and to keep building weather tight. Any materials damaged as a result of inclement weather shall be replaced at the Contractor's cost.

B. Existing Conditions:

1. Coordinate the Work with existing construction not included within this Section.
2. This includes sequencing the Work in order to provide proper interfacing with adjoining building elements, as well as ensuring the weather proofing integrity of the Work.

1.07 SCHEDULING

A. Sequence Work to ensure base sheet materials are in place before beginning the Work of this Section.

B. Sequence Work to ensure vapor retarder and/or air barrier materials are in place before beginning the Work of this Section.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Flat Stock

1. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate board thermal insulation shall comply with ASTM C1289-02. Insulation thickness shall not exceed 2.2 inches per board. Insulation boards shall be classified by facer type as follows:
   a. Type II, felt or glass-fiber mat on both major surfaces.
   b. Maximum board size: 4’ x 8’

2. Tapered panels constructed of polyisocyanurate board thermal insulation and comply with ASTM C1289-02. Taper shall be 1/8 inch per linear foot. Minimum board thickness shall be 1/2 inches. Maximum board thickness shall be 2 inches.
   a. Type II, felt or glass-fiber mat on both major surfaces.
   b. Maximum board size: 4’ x 4’
   c. The tapered insulation system shall be designed, manufactured, and supplied by a single source manufacturer.

B. Cover Board (where scheduled)

1. High Density Cover Board: High density, closed-cell, polyisocyanurate foam core fiberglass facer, 0.5 inch thick, Grade 2, complying with ASTM D1621.
   a. Maximum board size: 4’ x 4’

2.02 TAPERED INSULATION ACCESSORIES

A. Saddles/Crickets

1. Saddles/Crickets shall be constructed of tapered polyisocyanurate board insulation shall comply with ASTM C1289-02. Boards shall be faced with asphalt saturated glass-fiber mat. Taper shall be 1/4 inch per linear foot. Minimum board thickness shall be 1/2 inches. Maximum board size shall be 4’ x 4’.
   a. Type II, felt or glass-fiber mat on both major surfaces.
   b. Maximum board size: 4’ x 4’

2.03 RELATED COMPONENTS

A. Compressible Insulation: Fiberglass Batt Insulation, R11 (minimum), conforming to ASTM C665, Type 1 (unfaced).

B. Tapered Edge Strip: ASTM C208, impregnated fiberboard tapered from 1-5/8 inch to 1/8 inch (on 18 inch dimension), size 18 x 48 inches.

C. Urethane Adhesive: Urethane based adhesive for securement of insulation as manufactured or as recommended by the roof membrane manufacturer.

PART 3 - EXECUTION

3.01 THERMAL INSULATION APPLICATION

A. General

1. Neatly cut insulation boards to fit around all penetrations through the roof deck. At locations where less than a full size sheet of insulation is required, use the largest size practical to fill in the area. Do not install numerous small sections of the insulation at these locations.
2. Insulation boards with damaged facer sheet or broken edges shall not be incorporated into the work.
3. Fill gaps between insulation boards and between insulation boards and walls, curbs, blocking, and equipment with additional insulation material. Gaps between insulation boards in excess of 1/4 inch will not be accepted.
4. Protect all insulation from weather and standing water at all times. Install no more insulation than can be covered with the roofing membrane on the same day.
5. Tapered insulation edge stripping shall be installed at all perimeter edge details unless otherwise specified to provide for a smooth transition of new membrane and flashings as specified.
6. Tapered insulation cant stripping shall be installed at curbed projections or walls to provide for a smooth transition of new roof membrane and flashings as specified.

B. Thermal Insulation (Adhered to Vapor Retarder).

1. Adhere insulation boards in 3/4 inch - 1 inch diameter ribbons of urethane adhesive 6 (six) inches on center at perimeter, and 12 (twelve) inches on center at the field of the roof as recommended by the adhesive manufacturer. All insulation joints shall be staggered. Provide necessary weight per manufacturer's requirements to ensure proper adhesion.

C. Thermal Insulation (Multiple Layers / Mechanically Fastened)

1. Insulation securement requires one fastener every two square feet of board space. All insulation joints shall be staggered a minimum of twelve (12) inches.
2. All insulation joints shall be taped per manufacturer's standards and requirements, using manufacturer's recommended tape and adhesive.

D. Thermal Insulation (Multiple Layers / Adhesive Adhered)

1. All insulation boards shall be installed in 3/4 inch – 1 inch diameter ribbons of urethane adhesive 6 (six) inches on center at perimeter, and twelve (12) inches on center at the field of the roof as recommended by the adhesive manufacturer. All insulation joints shall be staggered. Install all boards in accordance with manufacturers recommended procedures and standards. Provide necessary weight per manufacturers requirements to ensure proper adhesion.

E. Saddles/Crickets

1. Saddles/crickets shall be installed in a solid application of adhesive as specified.
2. Saddles/cricket securement requires one fastener every two square feet of board space.

3.02 INSULATION SCHEDULE

A. Roof Areas AD-2, AD-3, CA-2, CR-1, CR-2, F1, F3, F4, F6, F7, P-1, P-3, P-4 and P-6

1. Vapor barrier - adhered
2. Two (2) layers - Polyisocyanurate insulation (2.2 inch) - adhered
3. 1/8 inch per foot two way tapered insulation system - adhered
4. 8 foot x 8 foot tapered sump at roof drains/scuppers - adhered
5. 1/2 inch high density polyisocyanurate cover board - adhered

B. Roof Areas EQ-1, BP-2(Barton Pumping Station) and IP-1A(Industrial Pumping Station)

1. Vapor barrier - adhered
2. Two (2) layers - Polyisocyanurate insulation (2.2 inch) - adhered
3. 1/8 inch per foot two way tapered insulation system - adhered
4. 8 foot x 8 foot tapered sump at roof drains/scuppers - adhered

C. Roof Areas F2 and F5

1. Vapor barrier - adhered
2. Two (2) layers - Polyisocyanurate insulation (2.2 inch) - adhered
3. 1/2 inch high density polyisocyanurate cover board - adhered

D. Roof Areas R1 and BP-1(Barton Pumping Station)

1. Vapor barrier - adhered
2. Two (2) layers - Polyisocyanurate insulation (2.2 inch) - adhered
3. 1/8 inch per foot four way tapered insulation system - adhered
4. 8 foot x 8 foot tapered sump at roof drains - adhered

E. Roof Area P-2

1. Two (2) layers - Polyisocyanurate insulation (2.2 inch) - mechanically attached
2. 1/8 inch per foot two way tapered insulation system - mechanically attached
3. 8 foot x 8 foot tapered sumps at roof drains/scuppers - mechanically attached
4. 1/2 inch high density polyisocyanurate cover board - mechanically attached

F. Roof Areas IP-1B(Industrial Pumping Station), NC-1(North Campus Pumping Station), LP-1(Liberty Pumping Station) and SH-1(Superior Hydroelectric Building)

1. Two (2) layers - Polyisocyanurate insulation (2.2 inch) - mechanically attached
2. 1/8 inch per foot two way tapered insulation system - mechanically attached
3. 8 foot x 8 foot tapered sumps at roof drains/scuppers - mechanically attached

END OF SECTION 07 22 00

SECTION 07 26 00

VAPOR RETARDERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Furnish all labor, materials, equipment, and supervision to install in accordance with the Contract Documents, all items listed but not limited to:
   a. Installation of vapor retarder to seal vapor gaps between adjacent materials forming wall and roof openings.
   b. Installation of sheet and sealant materials for controlling vapor diffusion.

1.02 REFERENCES

A. ASTM C920 - Elastomeric joint sealants

B. ASTM E96 - Test methods for water vapor transmission of materials

C. ASTM D2178 - Asphalt glass felt used in roofing and waterproofing

D. ASTM D226 - Asphalt saturated organic felts used in roofing and waterproofing

E. ASTM D4586 - Asphalt roof cement, asbestos free

F. ASTM D1004 - Test method for initial tear resistance for plastic film and sheeting

1.03 SUBMITTALS

A. Product Data

1. Submit data indicating material characteristics, performance criteria, and any limitations.
2. Submit manufacturer's installation instructions indicating preparation, installation or other specific procedures to be followed during installation.

1.04 QUALITY ASSURANCE

A. Qualifications

1. Installer
   a. Company specializing in performing the work of this section with a minimum of five years documented experience.

2. Manufacturer
   a. Company specializing in manufacturing the products specified in the Section with a minimum of ten years documented experience.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site with packages and labels intact identifying manufacturer, product name, and other numbers when appropriate.

B. Store materials in accordance with applicable manufacturer's recommendations and Material Safety Data Sheets.

C. Store approved materials in a suitable and designated area at the job site. Support materials off the ground and cover.

D. The designated staging area shall be restricted to storage of materials and related equipment.

E. Use necessary means to ensure safe storage and use of materials, as well as prompt and safe disposal of waste.

1.06 PROJECT SITE CONDITIONS

A. Environmental Requirements

1. Do not work in rain, snow, or in presence of water.
2. Do not install materials marked "Keep From Freezing" when daily temperatures are scheduled to fall below 40 F.
3. Remove any work exposed to freezing.
4. Advise Owner when volatile materials are to be used near air ventilation intakes so proper plans/precautions can be taken. No volatile materials are to be used near laboratory air ventilation intake.

1.07 SCHEDULING

A. Sequence Work to permit installation of materials in conjunction with other retardant materials and seals.

B. Do not install until items penetrating the vapor retarder are in place.

PART 2 - PRODUCTS

2.01 VAPOR RETARDER MATERIALS

A. Self Adhering Vapor Retarder: Self adhering elastomeric asphalt membrane with internal reinforcement and strippable treated release paper or film conforming to ASTM D 1970.

2.02 RELATED COMPONENTS

A. Asphalt Primer: ASTM D 41.

B. Thinner and cleaner for specified sheet: As recommended by sheet material manufacturer.

C. Cleaner: Non-corrosive type, recommended by sealant manufacturer; compatible with adjacent materials.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean and prepare substrate surfaces to receive specified vapor retarder.

3.02 EXISTING WORK

A. Clean and repair existing construction to provide a positive and continuous seal for vapor retarders.

3.03 SELF-ADHERING VAPOR RETARDER APPLICATION

A. Prime deck surface as specified.

B. Apply self-adhering vapor retarder beginning at the low point of the roof and align membrane along centerline of roof drain. Remove release film and adhere to substrate following manufacturer's instructions.

C. Position vapor retarder and hand rub onto the surface, followed by a pressure-applied roll pressing of the complete surface to assure positive adhesion.

D. Lap each sheet three (3) inches at side laps and six (6) inches at end laps. Reinforce around projections and drains as recommended by manufacturer.

E. Inspect vapor retarder before covering and repair as necessary. Cover tears and inadequate overlaps with membrane.

END OF SECTION 07 26 00

SECTION 07 53 00

ADHERED ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Furnish all labor, materials, equipment and supervision to provide the following in accordance with the Contract Documents.
   a. Adhered EPDM membrane roof system.
   b. Flashing and related components/accessories to provide a complete and warranted roofing system.

1.02 REFERENCES

A. Underwriters' Laboratories, Inc., Building Materials Directory

B. Manufacturer's Single-Ply Roofing Product Data and Application Guidelines

C. Factory Mutual System Approval Guide

1.03 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system for Class 1 or noncombustible construction. Materials with FM Approval markings.

1.04 SUBMITTALS

A. Product Data:

1. Submit Manufacturer's latest descriptive literature for each type of manufactured roofing materials as specified.

B. Materials List:

1. List of 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.

C. Shop Drawings

1. Shop drawings shall indicate installation layout, installation details, joint locations, special configurations and expansion provisions as required for this project.
2. Shop drawings shall not consist of a reproduction of the Consultant's details, but rather shall provide supplemental information pertaining to specific dimensions, sequencing requirements, joints and laps, as well as provisions for expansion and contraction as may be required for completion of the Work.

D. Manufacturer's Information:

1. Installation Instructions: Submit special procedures for perimeter conditions requiring special attention.
2. Manufacturer's Certificate: Certify submitted products meet or exceed specified requirements.
3. Copy of system Manufacturer's inspection report of completed roofing installation.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section with a minimum of ten years documented experience and that has UL listing for membrane roofing system specified herein.

B. Applicator: Company specializing in performing Work of this Section with minimum of five years documented in-service experience approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.07 PROJECT CONDITIONS

A. Advise Owner when volatile materials are to be used near air ventilation intakes so proper precautions can be planned and taken. No volatile materials are to be used near laboratory air ventilation intake.

B. Environmental Requirements

1. Do not work in rain, snow or in presence of water.
2. Do not install materials marked “keep from freezing” when daily temperatures are scheduled to fall below 40 degrees F.
3. Remove any work exposed to freezing.
4. Do not apply roofing membrane to damp or frozen deck surface.
5. Do not expose materials vulnerable to water or sun damage in quantities greater than can be waterproofed the same day.

1.08 SCHEDULING

A. The roof and building must be maintained watertight at the end of each day.

B. Completion of Work shall be defined as the installation of all specified roof preparation, insulation and field membrane.

C. Flashings, counter flashings, sheet metal, fasteners, and sealant work shall be coordinated and installed by the Contractor during the course of the Work.

D. All applicable masonry restoration work must be performed prior to roofing replacement.

PART 2 - PRODUCTS

2.01 EPDM MEMBRANE ROOFING

A. General

1. Comply with quality control, references, specification and manufacturer’s data.
2. Products containing asbestos are prohibited. Use only asbestos-free products.

B. EPDM: ASTM D 4637, Type II, scrim or fabric internally reinforced, uniform, flexible EPDM sheet.

1. Manufacturers:
   a. Carlisle SynTec Incorporated.
   b. Firestone Building Products.
   c. Thickness: 60 mils, nominal.
   d. Exposed Face Color: Black.

2.02 MATERIALS

A. Sheet Flashing: 60-mil thick EPDM, partially cured or cured, according to application.

B. Bonding Adhesive: Manufacturer's standard, solvent based.

C. Modified Asphaltic Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard modified asphalt, asbestos-free, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.

D. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.

E. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.

F. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch wide minimum, butyl splice tape with release film.

G. Seam Cover Strip: minimum five (5) inch wide stripping of pressure sensitive EPDM seam flashing membrane as recommended by the manufacturer.

H. Lap Sealant: Manufacturer's standard, single-component sealant.

I. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

J. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel, approximately 1 by 1/8 inch thick; with stainless steel anchors.

2.03 WALKWAY PADS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify surface and site conditions as satisfactory to receive work.

B. Do not begin roofing until all unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions.

C. Verify that work of other trades penetrating roof deck or requiring men and equipment to traverse roof deck has been approved by Owner, Consultant, manufacturer and roofing contractor.

D. Check projections, curbs, and deck for inadequate anchorage, foreign material, moisture, and unevenness that would prevent proper execution of new roofing system.

E. Verify deck surfaces are dry and free of snow or ice.

3.02 PROTECTION

A. All roofing, flashing, insulation, or other materials to be incorporated into the work shall be installed and sealed in a watertight manner on the same day.

B. At the start of each workday, drains within daily work area shall be plugged. Plugs are to be removed at the end of each workday.

C. Roof materials shall not be scraped, torn, bent, or otherwise damaged during unloading, storage or installation. Any materials, which have been mistreated or weathered, shall not be acceptable for application.

D. All surfaces shall be smooth, dry, and free from dirt, debris, and foreign matter before any treatment is initiated.

E. The Contractor shall be responsible for exercising all reasonable precautions to avoid fires being started, and shall provide suitable fire extinguishers, which are to be located so that they can be used when required. Competent operators shall be in attendance at all times when equipment is in use.

F. Preparation work shall be limited to those areas that can be covered with installed roofing material on same day or before arrival of inclement weather. Arrange work sequence to avoid use of newly constructed roofing for storage, walking surface, and equipment movement. Move equipment and ground storage areas as work progresses.

G. Prior to the application of any seam overlays, the Owner's Representative must review and approve all surface preparation. Should any deficiencies be found, the contractor shall correct prior to installing the seam overlay.

H. Provide clean plywood walkways and take other precautions required to prevent tracking of aggregate from existing membrane into new work area where aggregate pieces can be trapped within new roofing membrane. Contractor shall instruct and police his workmen to ensure that debris is not tracked into new work. Discovery of entrapped debris within new membrane is sufficient cause for rejection.

3.03 GENERAL WORKMANSHIP

A. Substrate: Free of foreign particles prior to laying roof membrane.

B. Phased roofing application will not be permitted.

C. Watertight Integrity: Roof system is to be watertight at the completion of each workday.

D. Traffic and Equipment: Protect completed single-ply roofing. Limit traffic over completed Work. Do not store equipment on roof membrane.

E. Entrapped Debris: Not permitted within new membrane. Its discovery is sufficient cause for rejection.

F. Base Flashing Height: Not less than eight inches above finished roof surface, unless otherwise designated in writing and authorized by the Consultant.

G. Elastomeric Flashing Adhesive: Allow solvent to flash prior to installation of flashing sheet.

3.04 EPDM MEMBRANE INSTALLATION

A. Membrane Installation (Adhered Single Ply)

1. Place membrane perimeter sheet over substrate surface without stretching. Allow membrane to relax a minimum of 30 minutes before final positioning, attaching and splicing.
2. Adjust membrane sheet to final position allowing for a minimum lap width of four inches. Membrane panels shall be installed so that seams shed the flow of water in a shingle fashion.
3. Fold back half of the membrane sheet onto itself without wrinkles to expose the underside meeting surface of sheet and insulation.
4. Sweep mating surfaces with a stiff broom to remove any accumulated dusting agent or dirt.
5. Apply membrane bonding adhesive with a solvent resistant paint roller. A uniform thickness of bonding adhesive shall be applied to both surfaces in accordance with manufacturer’s requirements. Spray application not permitted.
6. Place membrane into adhesive in accordance to manufacturer’s requirements and standards after bonding adhesive flashes off. Roll into place to minimize wrinkles.
7. Broom membrane after placement with a stiff bristle push broom to compress membrane sheet to substrate and remove entrapped air.

8. Repeat procedure to the remaining un-adhered half of the membrane sheet.
9. Install succeeding membrane sheet in same manner allowing for a minimum four inch overlap tolerance with adjoining sheets.
10. Where possible, extend field membrane as flashing over walls, parapets, curbs, etc. Provide membrane securement as specified in this Section.
11. Install membrane into roof drains in accordance with manufacturer's requirements.
12. Set membrane in manufacturer's recommended sealant. Install roof drain clamping ring and tighten all bolts to provide constant compression on roof system components.
13. Cut membrane sheet within drain bowl area as recommended by roof system manufacturer. Install new drain strainer/domes.

B. Membrane Seaming

1. Fabricate membrane seams using seam tape (or splice adhesive where required) in accordance with the roof system manufacturer's latest recommended installation procedures and requirements.
2. Broom across fabricated seams; remove wrinkles/entrapped air; ensure positive contact.
3. Hand roll across seam with two inch silicone hand roller to ensure positive contact. Roll first across the seam and then along the entire length of the seam.
4. Install a minimum six inch square patch of uncured EPDM flashing or pressure sensitive joint cover flashing membrane as recommended by the manufacturer over the joints at offsetting roll end laps. Hand roll to ensure positive contact.
5. Where roll end laps are continuous, overlay the lap with six inch wide strip of uncured EPDM flashing or pressure sensitive joint cover membrane as recommended by the manufacturer. Hand roll to ensure positive contact.
6. Check seams for continuity; leave no voids.
7. Caulk exposed leading edges with approved sealant and in accordance with the manufacturer's requirements for seam edge treatment.

C. Additional Scope of Work / Membrane Seams

1. All membrane seams shall be overlaid with specified seam cover stripping of pressure sensitive EPDM seam flashing membrane as recommended by the manufacturer. Clean and prime mating surfaces. Apply self-adhering pressure sensitive flashing membrane and hand roll to ensure positive contact.
2. Check seams to continuity; leave no voids.
3. Caulk exposed leading edges with approved sealant, and in accordance with the manufacturer's requirements for seam edge treatment.

D. Walkway Pads

1. Install specified walkway pads at locations to be designated by the Owner's representative.
2. Layout premanufactured pads so that flat surface is over EPDM membrane. Space pads a maximum of three inches to allow for drainage.
3. Adhere pads to EPDM membrane as recommended by the roof system manufacturer.

4. Install premanufactured pads below wood support blocking (i.e. gas and electrical lines, small units, etc.). Pads may be cut to required size.

3.05 FLASHINGS

A. Parapet Wall and Base Flashing

1. Remove existing flashing and counterflashing materials to substrate.
2. Install wood blocking as specified in Section 06100 and/or required by the manufacturer.
3. Install new roof membrane, as specified.
4. Install membrane base securement at walls and curbs.
5. Install the specified membrane sheet continuous as flashing at walls and curbs. Install the flashing membrane in accordance with the manufacturer's requirements for adhesion and appropriate substrate.
6. The flashing sheet shall continue up the wall, curb, or over the top of wood blocking at perimeter edges. The flashing sheet shall be nailed off on the front side of wood blocking six inches on center with one inch diameter cap nails.
7. Seal top edges of flashing sheet with a bead of specified butyl sealant installed between the substrate and backside of the flashing as detailed.
8. Firmly press top of flashing sheet into butyl sealant.
9. Install termination bar across top edge of base flashing assembly.
10. Mechanical securement shall be on 12 inch centers.
11. Wipe top of bar clean with metal cleaner prime metal surface to receive sealant with metal primer. Allow to dry.
12. Apply approved elastomeric sealant to the top of pressure bar. Provide watershed. Tool neatly.

B. Curbed Projection Flashing

1. Remove mechanical equipment from curb. Install additional blocking to raise curb a minimum height of eight inches above final roof surface.
2. Install new roofing membrane and flashing system per the manufacturer's flashing requirements.
3. Re-install fan/exhaust onto curb. Re-fasten with approved fasteners and rubber grommets, one fastener minimum on each side of curb.
4. Un-insulated curbs requiring flashing on vertical sides of the curb, shall receive one course of insulation prior to installing the flashing. The insulation shall be securely attached prior to adhering the flashing.
5. Install specified slip; insert counter flashing at units, which cannot be removed during flashing installation.

C. Fascia Installation

1. Install new elastomeric sheet roofing membrane up and over the cant base metal and adhered onto the face of the cleat four inches minimum.
2. Install new elastomeric flashing along and onto horizontal flange of primed fascia metal overlapping onto elastomeric membrane. Install sealant at leading edge along flashing sheet and exposed sheet metal.

D. Expansion Joint

1. Install single-ply membrane as specified. Extend field membrane as flashing up and over top edges of wood blocking.
2. Install flexible vapor retarder between curbing. Fasten vapor retarder eight inches on center to the top of the expansion joint curb. Fill with specified compressible insulation.
3. Install specified secondary waterproofing membrane over the top of expansion joint and vapor retarder. Splice adjoining sections together as recommended by the manufacturer. The membrane shall be placed loosely over top of expansion joint curb and shall extend down curb sides three inches.
4. Install new sheet metal expansion joint cover in accordance with specifications.

E. Area Divider

1. Install single-ply membrane as specified. Extend field membrane as flashing up and over top edges of wood blocking.
2. Install new sheet metal expansion joint cover in accordance with specifications.

F. Plumbing Vents

1. Install new roofing system to plumbing vent.
2. Install pre-molded pipe boot flashings, per the manufacturer's requirements.
3. Apply water block sealant behind upper leading edge of pipe boot.
4. Install draw band clamp and sealant for securement of pipe boot to penetration.
5. Install specified rain collar over all pipe flashings as detailed.

G. Round Protrusions (Stacks, Round Equipment Supports, Small Pipes, Conduits, etc.)

1. At heat stacks, install new metal isolated flashing. Secure to roof deck.
2. Projections that are 12 inches in size or larger on any side require installation of new treated wood blocking for securement of metal flashings.
3. Install new roof membrane to penetration.
4. Cracks and openings around flashing projection will be filled with compressible insulation. Clean and prime projections eight inches above the deck, allow to dry.

H. Penetration Pockets (Irregular Projections)

1. Cracks and openings around flashing projections will be filled with compressible insulation. Seal horizontal surface around projection with one ply of uncured flashing membrane.
2. Install specified roof membrane up to base projection. Seal around projection with EPDM compatible sealant.
3. Penetration pockets shall provide a minimum of three inches between edges and object being flashed. Penetration will be minimum five inches high with four inches on horizontal flanges. Corners of penetration pocket flanges will be solid with soldered seams.
4. New penetration pocket shall be constructed according to current NRCA details.
5. Clean and prime top and bottom of metal flange with appropriate primer.

6. Set penetration pocket flange around projections and flash in with uncured EPDM flashing. Extend flashing up, over and into penetration pocket and beyond edges of flange onto roof membrane a minimum of six inches.
7. Apply lap sealant to seams and edges of flashing membrane.
8. Penetration pockets will be filled with three inches of non-shrink grout. After proper curing the grout will be covered with specified pourable sealer in sufficient height to provide a positive watershed.

3.06 DAILY WATER STOPS / TIE-INS

A. Clean and dry the surface of the existing single ply roof system along edges of termination.

B. Install dead-man insulation fillers at insulation staggers or voids between new and existing roof insulation.

C. Position new single ply membrane to allow for a minimum six inch overlap onto surface of existing roofing. Adhere mating surfaces as recommended by roof system manufacturer.

D. Check seams for continuity; leave on voids.

E. At the beginning of next day's work, remove temporary connection by cutting along edge of existing roof system.

END OF SECTION 07 53 00

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Furnish all labor, materials, equipment and supervision to install in accordance with the specifications and drawings all items listed, but not limited to:
   a. Shop Fabricated Fascia components
   b. Shop Fabricated Coping components
   c. Shop Fabricated Gutter and Downspout components
   d. Shop Fabricated Sheet Metal Flashing components
   e. Shop Fabricated Scupper components
   f. Field of the Roof Sheet Metal components

1.02 REFERENCES

A. ASTM A 666 - Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. ASTM B 32 - Specification for Solder Metal.

C. SMACNA (Sheet Metal and Air Conditioning Contractors National Association) Architectural Sheet Metal Manual, latest edition.

D. NRCA (National Roofing Contractors Association) - Roofing and Waterproofing Manual, latest edition.

E. AAMA 611 (American Architectural Manufacturers Association) - Standards for Anodized Architectural Aluminum.

F. ASTM A 653/A0653M - Steel Sheet, Zinc Coated (Galvanized) of Zinc-Iron Alloy-Coated by the Hot-Dip Process.

G. ASTM B 209/B 209M - Specification for Aluminum and Aluminum-Alloy Sheet and Plate

H. ASTM B 370 - Specification for Copper Sheet and Strip for Building Construction.

I. ASTM B 749 - Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.

J. CDA (Copper Development Association) - Copper in Architecture – Handbook, latest edition.

K. ANSI/SPRI ES-1, Wind Design Standard for Edge Systems Used with Low-Slope Roofing Systems.

1.03 PERFORMANCE REQUIREMENTS

A. General Performance: Installed sheet metal flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Material Compatibility: Provide sheet metal materials that are compatible with one another under conditions of service and application required.

C. Prefabricated and Shop Fabricated Fascia

1. All perimeter sheet metal fascia installations shall be fabricated and installed in accordance with ANSI/SPRI ES-1, "Wind Design Standard for Edge Systems Used with Low Slope Roof Systems.
2. System shall provide a minimum safety factor of 2 on maximum wind loads and/or provide a minimum wind resistance of 180 psf.
   a. RE-2, Pull-off test for edge flashings.

1.04 SUBMITTALS

A. Product Data:

1. Submit Manufacturer's latest descriptive literature for each type of sheet metal materials as specified.

B. Materials List:

1. List of 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.

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Metal profiles and attachment methods.
2. Identification of materials, thickness, weight and finish for each item, and locations for each to be installed.

D. Manufacturer's Information:

1. Installation Instructions: Submit special procedures for perimeter conditions requiring special attention.
2. Manufacturer's Certificate: Certify submitted products meet or exceed specified requirements.
3. Copy of system Manufacturer's inspection report of completed installation.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section with a minimum of ten years documented experience and that has UL listing and ES-1 verified testing for sheet metal system specified herein.

B. Applicator: Company specializing in performing Work of this Section with minimum of five years documented in-service experience approved, authorized, or licensed by manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

1. Applicator will be required to submit manufacturer's ANSI/SPRI ES-1 test report verifying safety factor on design wind load as specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials causing discoloration or staining.

1.07 COORDINATION

A. Coordinate work of this Section with interfacing and adjoining work for proper sequencing of each installation.

B. Coordinate with Work of Other Sections for installing recessed flashing reglets.

PART 2 - PRODUCTS

2.01 SHOP FABRICATED METAL COMPONENTS

A. General Fabrication

1. Form all sheet metal pieces in longest practical lengths.
2. Hem exposed edges on underside of all perimeter systems every six (6) feet and all ends; miter and seam corners.

B. Two-Piece Free-Floating Fascia Systems

1. Cleat/Cant Dam
   a. 22 gage galvanized, face and top fastened.
   b. Two Inch high profile, 50° cant dam with minimum 3 inch flange and 3/4 inch to 1 inch cleat return.

2. Fascia Metal Fabrication

a. Pre-Finished Galvanized Steel Sheet: ASTM A 924/A 924M, Grade A, 24 gage core steel, shop pre-coated with fluoropolymer (Kynar/Hylar) coating; color as selected by Owner from manufacturer's standard colors.
b. Mitered Corners: Solid inside and outside fabricated corners are required to ensure complete coverage with sheet metal.

C. Coping Systems

1. Fabricate sections not exceeding 10-feet long. Fabricate joint plates of same thickness as copings. Miter corners, seal, and solder or weld watertight.
2. Cleat
   a. 22 gage galvanized, face fastened.

3. Coping Metal
   a. Pre-Finished Galvanized Steel Sheet: ASTM A 924/A 924M, Grade A, 24 gage core steel, shop pre-coated with fluoropolymer (Kynar/Hylar) coating; color as selected by Owner from manufacturer's standard colors.
   b. Mitered Corners: Solid inside and outside fabricated corners are required to ensure complete coverage with sheet metal.

D. Counterflashing and Expansion Joint Covers Area Divider Covers Materials

1. Pre-Finished Galvanized Steel Sheet: ASTM A 924/A 924M, Grade A, 22 gage core steel, shop pre-coated with fluoropolymer (Kynar/Hylar) coating; color as selected by Owner from manufacturer's standard colors.
2. Stainless Steel: ASTM A 666, Type 304, soft temper, 22 gage thick; smooth finish.
3. Copper: ASTM B 370, cold rolled; natural finish.

E. External Sheet Metal Gutter and Downspout System

1. Sheet Metal Gutter
   a. Materials
      1) Pre-Finished Galvanized Steel Sheet: ASTM A 924/A 924M, Grade A, 22 gage core steel, shop pre-coated with fluoropolymer (Kynar/Hylar) coating; color as selected by Owner from manufacturer™s standard colors.
   b. Gutter Profile: SMACNA profile, Figure 1-2 Style A. 7"W x 6"D.
   c. Gutter Expansion Joints: Butt Type.
   d. Gutter Supports: Brackets. 1/8" x 1"; Galvanized Steel, powder coated; spaced at greater than 36 inches on center.

2. Sheet Metal Downspouts
   a. Materials
      1) Downspouts: SMACNA profile, Figure 1-32B; Size 5"W x 4"D. Downspouts to be fabricated from same material as sheet metal gutter.
      2) Outlets SMACNA profile, Figure 1-33, Detail 1.
      3) Downspout Supports: Straps; same gage as downspout material. Straps shall be installed directly below outlet and above discharge, and spaced no greater than 5 feet on center.
      4) Provide concrete splash blocks at discharge locations.

5) Provide downspout extensions at grade to move water away from foundation.

F. Roof Edge Scuppers

1. Materials
   a. Pre-Finished Galvanized Steel Sheet: ASTM A 924/A 924M, Grade A, 22 gage core steel, shop pre-coated with fluoropolymer (Kynar/Hylar) coating; color as selected by Owner from manufacturer's standard colors.
   b. Stainless Steel: ASTM A 666, Type 304, soft temper, 22 gage thick; smooth finish.
   c. Copper: ASTM B 370, cold rolled; natural finish.

2. Fabricate scuppers of dimensions required with closure flange trim to exterior, 4 inch wide wall flanges to interior, and base extending 4 inchesbeyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
3. Fabricate with connection for sized conductor head and downspout applications.
4. Fabricate with a four inch extension base piece for run-off drainage away from building perimeter.

G. Metal components used for flanges, rain collars and penetration pockets within the field of roof as specified shall be: Stainless Steel: ASTM A 666, Type 304, soft temper, 24 gage thick; smooth finish.

2.02 ACCESSORIES

A. Primer: Asphalt Primer, ASTM D 41.

B. Lead Flashing Sheet for Drains: ASTM B 749, 4.0 lb/sq ft.

C. Lead Plumbing Vent Flashing: ASTM B 749, 2.5 lb/sq ft.

D. Copper Plumbing Vent Flashing: ASTM B 370, 16 ounce.

E. Solder: ASTM B 32; type suitable for application and material being soldered with compatible flux.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, blocking pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing terminations and base flashings are in place, sealed, and secure.

C. Verify surfaces to receive sheet metal flashings are clean and in sound condition.

D. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that work will properly commence. Do not proceed with installation until unsatisfactory conditions are correct.

3.02 GENERAL REQUIREMENTS

A. Examine the areas of Work and verify that existing conditions are acceptable for the specified installation procedures. Report, in writing, adverse conditions that could affect the performance of the Work within five calendar days. Absence of written notification will indicate the Contractor's acceptance of existing project conditions.

1. Verify surfaces to receive sheet metal are clean and in sound condition.
2. Examine substrates and conditions under which sheet metal components are to be installed and verify that Work will properly commence.

B. Preparation:

1. Secure flashings in place using specified fasteners.
2. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
3. Seal metal joints watertight.

C. Manufacturer’s Recommendations: Comply with the manufacturer’s written approved installation instructions and with any governing regulations and industry standards applicable to the Work.

D. Form sheet metal on a bending break. Perform shaping, trimming, and hand seaming in the shop as far as practicable, with the proper sheet-metal working tools. Make the angle of the bends and the folds for interlocking the metal with full regard for expansion and contraction, to avoid buckling or other deformation in service. All lines shall be straight and crisp except where thickness of metal dictates radius bend, and all exposed edges shall be hemmed 1/2 inch minimum.

E. Soldering - Copper Flashing and Stainless Steel Flashing: Prior to soldering, mechanically clean all metal to be soldered with steel wool or by other acceptable means, apply flux, and pre-tin. For lead coated copper, remove lead coating by sanding or grinding to produce bright red surface prior to applying flux and pre-tinning. Clean metal again if it is not soldered on the same work day. Perform all soldering with well heated heavy (10 pounds per pair) irons with tinned clean blunt tips. Do not use torches. Apply enough heat to sweat the solder through the full width of the seam. Close clinch lock seams gently with a block of wood and mallet, then flux and show at least one full inch of continuous solder. Whenever possible, do all soldering in flat position. All sloped and vertical seams shall be laced and soldered a second time. Wipe and wash clean soldered joints to remove all traces of acid from the flux after the joints are made.

F. Sheet Metal Expansion Joints:

1. Layout metal flashing to minimize transverse joints. Detail transverse joints in all flashing pieces to provide a watertight connection, and allow for expansion/contraction of the metal as shown on the Drawings.

2. Unless shown otherwise on the Drawings, provide expansion joints at 24 feet on-center maximum and at 2 feet away from all changes in flashing direction (each side) and from all terminations of flashing.

G. Prefabricated Transitions/Terminations:

1. Provide pre-fabricated corner pieces with joints locked, riveted, and soldered watertight. Space rivets at 1 inch on-center in staggered pattern unless otherwise indicated.

H. Miscellaneous

1. Apply flashing cement compound between metal flashings and felt flashings.

3.03 INSTALLATION OF SHOP FABRICATED METAL COMPONENTS

A. Gravel-Stop Fascia System

1. Prior to setting and nailing horizontal flanges of metal edge, prime top and bottom of metal flange with cut back primer, allow to dry, then trowel a layer of 1/16 inch thickness of roof cement to roofing surface receiving metal flange.
2. Fabricate and install metal edge detail with formed drip edge incorporating a 3/4 inch lock.
   a. Flange Width: Four inches (minimum)
   b. Rise: 3/4 inch x 45 degrees

3. Secure fascia bottom with a 3/4 inch lock secured to a continuous cleat nailed three inches o.c. Gap fascia ends 1/2 inch; overlap cleat joints one inch. Set primed flange in roof cement. Cover fascia ends with enclosure profiled to slide through gap between fascia joints.
4. Nail interior portion of flange to wood blocking three inches o.c., staggered.

B. Two-Piece Free-Floating Fascia System

1. Fabricate and install metal edge detail with formed drip edge incorporations 1.0 inch lock.
   a. Flange Width: Three inches (minimum)
   b. Rise: Two inches x 45 degrees

2. Position new cant dam at perimeter edges and secure vertical leg to substrate using fasteners spaced six inches on center maximum.
3. Nail interior portion of flange to wood blocking three inches o.c., staggered.
4. Install fascia system over fully secured cant dam. Ensure a tight fit and positive conformance to cant dam.
5. Install mitered and sealed corners.
6. Crimp bottom edge of fascia over cleat/cant dam at ends and every two feet on-center throughout each metal section length.

C. Shop Fabricated Metal Coping System:

1. Install a continuous cleat on the outside face of the wood blocking, secure six inches on center with specified fasteners.

2. Install new coping constructed of specified metal. Coping width shall be sufficient to extend 1-1/2 inches minimum below top edge of wall.
3. Install concealed cover plates at all metal coping joints. Install two sided Butyl tape to outside edges of cover plate prior to installing the coping. Gap coping ends 1/2 inch, minimum.
4. Install coping to the continuous cleat on front and secure on inside face with mechanical fasteners with rubber grommets, 24 inches on center.
5. Apply a bead of specified sealant to the horizontal surface of the coping joint.

D. Termination Bar/Counterflashing (Wall Transitions)

1. Install termination bar across top edge of base flashing assembly.
2. Mechanical securement shall be on six inch centers.
3. Wipe top of bar clean with metal cleaner. Prime metal surface to receive sealant with metal primer. Allow to dry.
4. Apply approved elastomeric sealant to the top of pressure bar. Provide watershed. Tool neatly.
5. Install counterflashing detail over top of pressure bar in conformance to counterflashing detail, and approved manufacturer's specification requirements.
6. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

E. Through-Wall Flashing

1. Provide new masonry flashings at locations indicated on Drawings.
2. Remove all existing mortar, deficient flashing materials and clean surfaces that are to receive flashings.
3. Install prefabricated pan flashings with maximum 24 inch legs with riveted and sealed seams at wall corners and transition details. Otherwise, fabricate and install flashings with maximum available lengths. Incorporate riveted and sealed sheet metal end dams at all flashing terminations.
4. In field of walls, overlap pan flashing ends a minimum 6 inches. Set overlapped ends in full bed of waterproofing mastic compatible with flexible sheet membrane.
5. Fully adhere flexible sheet flashing to horizontal leg of metal pans and to clean, sound inboard wall surfaces. Use primer on inboard wall surfaces as required for proper adhesion. Lap ends of sheet flashing a minimum 6 inches. Seal all flashing ends and terminations with compatible waterproofing mastic.
6. Install termination bar to top of flexible flashing with masonry anchors maximum 12 inches on-center and caulk top edge with polyurethane sealant.
7. At masonry expansion joints, flashing system shall run continuously through without termination.

F. Gutter and Downspouts

1. Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to anchored straps spaced not more than 36 inchesapart. Provide end closures and seal watertight with sealant.
   a. Fasten gutter spacers to front and back of gutter.
   b. Loosely lock straps to front gutter bead and anchor to roof deck.
   c. Anchor and lock back edge of gutter to continuous [**cleat**] [**eave or apron flashing**].

d. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inchesapart.
e. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feetapart. Install expansion-joint caps.
f. Install continuous gutter screens on gutters with noncorrosive fasteners, [**removable**] [**hinged to swing open**] for cleaning gutters.
g. Slope gutters minimum 1/4 inch per foot to downspouts.

2. Set splash pads under downspouts.
3. Seal metal joints watertight.

G. Expansion Joint Cover Area Divider Cover

1. Install a continuous cleat on the outside face of the nailer, secure eight inches o.c. with specified fasteners.
2. Metal cover seam shall be joined together by fabrication of 1 (one) inch vertical standing seams. Apply specified urethane sealant between metal joints prior to locking joints together.
3. Install concealed plates at all metal joints. Install two sided Butyl tape to outside edges of metal cover prior to installing cover plates. Gap ends 1/2 inch, minimum. Apply a bead of sealant to outer edges of cover plate on horizontal surface.
4. Install cover to the continuous cleat on front and secure on inside face with mechanical fasteners with rubber grommets, 24 inches on center.
5. Apply a bead of specified sealant to the horizontal surface of the coping joints.

H. Roof Edge Scuppers

1. Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
   a. Anchor scupper closure trim flange to exterior wall and solder to scupper.
   b. Lock front edge of scupper with conductor head.
   c. Solder exterior wall scupper flanges into back of conductor head.

I. Plumbing Vents

1. Apply 1/16 inch uniformly thick layer of roof cement to surface receiving metal flange. Provide fillet of roof cement at vent base.
2. Fabricate and install plumbing vent flashing from lead. Flange: four inches wide minimum; extend completely around periphery of vent flashing. Set primed flange into roof cement. Neatly dress flange with wood block.
   a. Pipe outside diameter greater than two inches. Bend lead inside pipe one inch minimum with pliers or rubber/plastic mallet; replace cracked lead.
   b. Pipe outside diameter two inches or less. Cut lead at vent top; fabricate and install integral lead cap.

3. Prime top of flange with asphalt primer, as required.

J. Round Protrusions

1. Round protrusions will be flashed with a two piece flange and umbrella metal flashing.
2. Flanges and umbrellas shall be constructed of stainless steel.
3. All seams and splices shall be soldered. Flanges that will not slide over the top of the pipe will require job site soldering. Clean and prime top and bottom sides of flanges.
4. Mechanically fasten flashing flange to treated wood nailers beneath.
5. Set umbrella and seal the umbrella with two side Butyl tape on inside flange/face.
6. Secure clamp at umbrella. Apply a heavy cove bead of elastomeric sealant to the upper leading edge. Tool in place.
7. Irregular Projections: Weld steel plate (1/4 inch thickness, minimum) to the projection to secure the hood in place and provide watertight seal.
8. At small pipes:
   a. Fabricate and install stainless steel umbrella with minimum one inch flange/face.
   b. Wipe clean top of umbrella and projection with metal cleaner.
   c. Apply elastomeric sealant to the stack sheet metal interface.
   d. Provide watershed. Tool neatly.

9. Prime top of flange with asphalt primer, as required.

K. Slip Insert Counterflashings At Roof Top Units

1. Install specified counterflashing behind the existing roof top unit flashing receiver.
2. Secure counterflashing to flashing receiver with specified fasteners with compression gaskets spaced 12 inches on center.
3. Secure counterflashing into existing roof curb with specified fasteners with compression gaskets spaced 12 inches on center. Counterflashing shall be installed behind flashing receiver as high as possible. Fasteners shall be installed maximum of one inch below flashing receiver.

L. Penetration Pockets (Irregular Projections)

1. Penetration pockets shall provide a minimum of three inches between edges and object being flashed.
2. Penetration pockets shall be minimum five inches high with four inches on horizontal flanges. Corners of penetration pockets shall be solid with soldered seams.
3. Penetration pockets shall be constructed according to current NRCA details.
4. Prime metal flange, projection and penetration pocket interior with asphalt primer.
5. Penetration pockets shall be covered with stainless steel umbrella with a minimum of one inch covering beyond of pitch pocket sides. Hood metal will have 1/2 inch clearance of pitch pocket metal.
   a. Fabricate and install stainless steel umbrella with minimum one inch flange/face.
   b. Wipe clean top of umbrella and projection with metal cleaner. Prime surface with metal primer.
   c. Apply elastomeric sealant to the stack sheet metal interface.
   d. Provide watershed. Tool neatly.

6. Irregular Projections: weld steel plate (1/4 inch thickness, minimum) to the projection to secure to secure the hood in place and provide watertight seal.

M. Gravel Guard

1. Install stainless steel gravel guard, 36 inches square at all drains.
2. The stainless steel gravel guard shall be formed with a four inch flange and one inch hemmed guard with saw tooth cut outs.
3. The flange shall be primed top and bottom with asphalt primer.

3.04 FIELD QUALITY CONTROL

A. Inspection will involve surveillance of Work during installation to ascertain compliance with specified requirements.

END OF SECTION 07 62 00

SECTION 07 62 50

METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment, and incidentals required to perform installation, repair and restoration of sheet metal work.

B. Work for this Section includes the following:

1. Provide sheet metal components and required accessories for the following:
   a. Through-wall flashing
   b. Drip edges

C. All new materials are to be interfaced with, and integrated into, existing materials to provide completed work that is sound and weathertight.

1.02 REFERENCES

A. References are latest editions, unless otherwise indicated.

B. American Society for Testing and Materials (ASTM)

1. ASTM A 653: Steel Sheet, Zinc Coated (Galvanized) of Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 666: Austenitic Stainless Steel Sheet, Strip, Plate, and Flat bar.
3. ASTM A 924: Steel Sheet, Aluminum-Zinc-Alloy-Coated by the Hot-Dip Process, Structural (Physical) Quality.
4. ASTM B 32: Solder Metal.
5. ASTM B 101: Lead-Coated Copper Sheet and Strip for Building Construction.
6. ASTM B 209: Aluminum and Aluminum-Alloy Sheet and Plate.
7. ASTM B 370: Copper Sheet and Strip for Building Construction.
8. ASTM B 749: Lead and Lead Alloy Strip, Sheet, and Plate Products.

C. Factory Mutual (FM)

1. Factory Mutual Windstorm Approval

D. Underwriters Laboratories (UL)

1. UL 580: Test for Wind Uplift Resistance of Roof Assemblies

E. Copper Development Association (CDA): Copper in Architecture – Handbook.

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

G. Copper and Common Sense by Revere Copper.

1.03 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. When required, fabricate and install copings capable of resisting the anticipated for the building according to recommendations in FMG Loss Prevention Data Sheet 1-49.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product literature and performance data for all metal types and finishes.

B. Samples: Submit the following for verification purposes:

1. Two (2) samples, 3 x 3 inches in size, for proposed metal colors and/or finish.

C. Hardware List: Submit a complete list of incidental materials to be provided under this Section.

D. Shop drawings for all metal flashing details, including dimensions, sequencing requirements, conditions of interfaces with other materials, joints and termination detail conditions as well as provisions for expansion and contraction as may be required for completion of Work.

1.05 QUALITY ASSURANCE

A. Contractor Qualifications: Not less than five (5) current years successful experience with comparable projects and employing personnel skilled in sheet metal fabrication, installation, and related work.

B. Source of Materials: Obtain materials from a single source for each type required to ensure quality, color, match, and texture.

C. Install sheet metal components to withstand wind loads, structural movement, thermally induced movement and exposure to weather without failing.

D. Field Sample: Prior to starting full-scale installation of the Work, prepare the following sample applications. Do not proceed with field samples until all materials have been submitted and approved.

1. Ten (10) lineal feet of through-wall flashing with joint/seam, including all associated materials, including back-up waterproofing, sealants, etc.
2. Five (5) metal panels, including attachment clips, underlayment(s), etc.
3. Ten (10) lineal feet with joint/seam, minimum, of coping flashing.
4. Ten (10) lineal feet with joint seam, minimum, of counterflashing.
5. Acceptable field samples, and method of procedure, will become the standard for Work of this Section.

E. Pre-Installation Conference: Convene prior to commencing Work with the Owner and Consultant to discuss sequencing and installation procedures.

1.06 PRODUCT HANDLING

A. Coordinate locations for on-site staging and storage areas with the Owner.

B. Package and neatly store materials in a manner that prevents surface damage, distortion, breakage or structural weakening. Slope metal sheets to ensure drainage. Replace any damaged materials.

1.07 PROTECTION

A. Protect elements surrounding the Work from damage or disfiguration.

1.08 WARRANTY

A. Reference Section 01 78 00 - Project Closeout and Warranties.

PART 2 - PRODUCTS

2.01 GENERAL

A. Listed are primary products and materials for the specified repair work. Provide all incidental items and materials required for completion of the Work in accordance with these documents.

2.02 METAL COMPONENTS

A. Metal components used for flashings shall be:

1. Stainless Steel: ASTM A 666, Type 304, soft temper, 22 gage thick; smooth finish.
2. Copper: ASTM B 370, cold rolled 16 oz/sq ft.]; natural finish.

B. Shop Fabricated Metal Components

1. Qualifications

a. Fabricating Contractor must have at least five (5) years documented experience fabricating and installing similar sheet metal assemblies. Provide references to Consultant upon request.
b. Precision must be used in the fabrication of assemblies in accordance with industry standards.

2.03 ACCESSORIES

A. Flexible Sheet Flashing:

1. Type: Self-adhering, reinforced, rubberized asphalt sheet membrane.
2. Thickness: Minimum 40 mils.
3. Acceptable Product: “Perm-A-Barrier Wall Flashing” by Grace Construction Products.
4. Primer: “Perm-A Barrier Surface Conditioner” or as recommended by the sheet membrane manufacturer.
5. Provide minimum 1 inch high, stainless steel or aluminum termination bar anchored 8 to 12 inches on-center along top edge of sheet flashing.

B. Seam and Lap Joints Membrane:

1. Type: Rubberized asphalt-based liquid membrane.
2. Acceptable Product: “Bituthene Liquid Membrane” by W.R. Grace.

C. Anchors/Fasteners

1. Masonry: Hilti “Kwik-Con II” or ITW “Tapcon” screw anchors, minimum 1/4 inch diameter shank, and of sufficient length to provide minimum 1-1/4 inch embedment into masonry. Where exposed to exterior, provide paint fasteners (matching the flashing color), with weather-seal washers.
2. Steel: Self-drilling / tapping screws.
3. Protective Coating: All fasteners to be galvanized steel with flouropolymer coating.

D. Sealant: [**silicone** sealant. Refer to Section 07920, Joint Sealants for specific material requirements.

E. Slip Sheet: Rosin sized building paper, 3-lb/100 sqft. minimum.

F. Solder:

1. Red Copper / Stainless Steel: ASTM B 32, Class 50A or 50B, Bar Form, 50% block tin and 50% pig lead.

G. Flux: Conforming to ASTM B813.

PART 3 - EXECUTION

3.01 GENERAL

A. Examine the areas of Work and verify that existing conditions are acceptable for the specified installation procedures. Report, in writing, adverse conditions that could affect the performance of the Work within five calendar days. Absence of written notification will indicate the Contractor's acceptance of existing project conditions.

1. Verify surfaces to receive sheet metal are clean and in sound condition.
2. Examine substrates and conditions under which sheet metal components are to be installed and verify that Work will properly commence.

B. Measurements: Before ordering materials or performing work, obtain and verify all measurements at the building site. Exact measurements are the Contractor's responsibility.

3.02 GENERAL FABRICATION

A. Form sections to shape indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Form sheet metal on a bending break. Perform shaping, trimming, and hand seaming in the shop as far as practicable, with the proper sheet-metal working tools. Make the angle of the bends and the folds for interlocking the metal with full regard for expansion and contraction, to avoid buckling or other deformation in service. All lines shall be straight and crisp except where thickness of metal dictates radius bend, and all exposed edges shall be hemmed 1/2 inch minimum.

C. Fabricate cleats of same material as sheet metal, interlocking with sheet.

D. Form pieces in longest practical lengths.

E. Hem exposed edges on underside 1/2 inch.

1. Fabricate vertical faces with bottom edge formed outward 3/4 inch at 30^{o} angle and hemmed to form drip.

F. Soldering - Copper Flashing/Stainless Steel Flashing: Immediately prior to soldering, mechanically clean all metal to be soldered with steel wool or by other acceptable means, apply flux, and pre-tin. For lead coated copper, remove lead coating by sanding or grinding to produce bright red surface prior to applying flux and pre-tinning. Clean metal again if it is not soldered on the same work day. Perform all soldering slowly with well heated heavy (10 pounds per pair) irons with properly tinned clean blunt tips. Do not use torches. Apply enough heat to sweat the solder completely through the full width of the seam. Close clinch lock seams gently with a block of wood and mallet, then flux and show at least one full inch of continuous and evenly flowed solder. Whenever possible, do all soldering in flat position. All sloped and vertical seams shall be laced and soldered a second time. Wipe and wash clean soldered joints to remove all traces of acid from the flux immediately after the joints are made.

G. Flashing Joints – Non-Expansion: Form typical non-expansion flashing joints by overlapping 4 inches, and riveting and covering with membrane strip flashing and metal cover plate.

H. Expansion Joints: Layout metal flashing to minimize transverse joints. Detail transverse joints in all flashing pieces to provide a watertight connection, and allow for expansion/contraction of the metal as shown on the Drawings. Unless shown otherwise on the Drawings, provide expansion joints at 24 feet on-center maximum and at two (2) feet away from all changes in flashing direction (each side) and from all terminations of flashing. Form typical flashing expansion joints by overlapping 4 inches, and covering with membrane strip flashing and metal cover plate.

I. Prefabricated Transitions/Terminations: Provide pre-fabricated corner pieces out of one piece of metal with joints locked, riveted, and covered with membrane strip flashing and sealant watertight. Space rivets at 1 inch on-center in staggered pattern unless otherwise indicated.

3.03 INSTALLATION

A. Through-Wall Flashing

1. Provide new masonry flashings at locations indicated on Drawings.
2. Remove all existing mortar, deficient flashing materials, etc. and clean surfaces that are to receive flashings.
3. Install metal flashing over substrate. Provide end dams and other transition/termination flashing, as required to provide a complete system.
4. Fully adhere membrane sheet flashing to vertical leg of metal through-wall flashing and to wall surface above the flashing. Use primer on wall surfaces as required for proper adhesion. Lap ends of membrane sheet flashing a minimum 6 inches. Seal all flashing ends and terminations with compatible waterproofing liquid membrane.
5. Install termination bar along the top of membrane flashing with masonry anchors at a spacing of 16 inches on-center. Cover termination bar and fasteners with liquid membrane.

B. Reglet-Set Counterflashing

1. Saw-cut reglets in the existing masonry or concrete substrates.
2. Install metal receiver in reglet, and fasten at a maximum spacing of 16 inches on center.
3. Install backer rod and sealant, as specified in Section 07 92 00 – Joint Sealants.
4. Install metal counterflasing into receiver and secure bottom edge with concealed cleats.

C. Surface-Mounted Flashing

1. Back-seal surface-mounted flashing to substrate with butyl tape sealant.
2. Secure flashing, through butyl sealant, at a maximum spacing of 16 inches on-center.
3. Install sealant along top edge of flashing, as specified in Section 07920- Joint Sealants.

D. Window Sill Flashing

1. Form a minimum 1 inch horizontal leg with upturned edge to wedge between the base of window frames and sill brick, and secure with masonry screws. Fabricate vertical outboard leg with 3/4 inch drip and of length to cover sill.
2. Prior to installation of metal flashing, install membrane flashing, as specified. Clean and properly prepare surfaces to receive sheet flashing in accordance with manufacturer's instructions. Fully adhere membrane flashing to sill in one continuous length. Use primer on wall surfaces as required for proper adhesion.
3. After installation of metal, prime top edge of cap flashing, if required, install sealant in accordance with Section 07920 – Joint Sealants.

E. Metal Coping Flashing

1. Install a continuous cleat on the inside and outside faces of the wall.
2. Install coping, engaging the cleat on the first side, and field bending the second edge to fully engage the cleat.
3. Provide metal cover plates over joints to conceal membrane flashing, engaged with the coping flashing hem.

3.04 FIELD QUALITY CONTROL

A. Contractor shall maintain or exceed levels of workmanship and material acceptability in regard to surface preparation and installation as established by mock-up/test samples.

B. Contractor shall employ trained, skilled and experienced craftsmen for all phases of the Work.

C. Contractor shall make provision to assist and coordinate monitoring of the Work by the Manufacturer and Owner Representatives.

3.05 ADJUSTING AND CLEANING

A. Clean site of all unused materials and waste in accordance with environmental regulations.

B. Remove and dispose of all materials used to protect surrounding areas and building surfaces, following completion of the Work of this Section.

C. Repair, restore, or replace all materials, landscaping, interior finishes, and surfaces damaged by the Work to the satisfaction of the Owner at no additional expense.

END OF SECTION 07 62 50

SECTION 07 70 00

ROOF SPECIALTIES AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Furnish all labor, materials, equipment and supervision to prepare and install the following:
   a. Prefabricated curbs/equipment supports
   b. Pre-fabricated Pipe Supports
   c. Pre-fabricated Walkway Platforms

1.02 REFERENCES

A. NRCA (National Roofing Contractors Association) Roofing and Waterproofing Manual.

B. SMACNA - Architectural Sheet Metal Manual

C. FM - Roof Assembly Classifications

D. UL - Fire Hazard Classifications

1.03 SUBMITTALS

A. Product Data

1. Provide manufacturers latest descriptive literature on shape/size of components, materials and finishes, installation instructions and/or special procedures to be followed during installation.
2. For each type of product indicated, include instruction details, materials, dimensions of individual components and profiles and finishes.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements

1. Perform Work in accordance with SMACNA and NRCA details.
2. Conform to applicable Code for UL requirements for specified fire rated components.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site with packages and labels intact identifying manufacturer, product name and lot numbers when appropriate.

B. Store materials in accordance with applicable manufacturer's recommendations.

C. Store approved materials in a suitable and designated area at the job site. Support materials off the ground and cover.

D. Use necessary means to ensure safe storage and use of materials as well as prompt and safe disposal of waste.

PART 2 - PRODUCTS

2.01 PRE-MANUFACTURED COMPONENTS

A. Guy Wire Supports: Standard 14" high epoxy coated, urethane insulated hollow steel supports as manufactured by Thaler Metal Industries.

B. Premanufactured Pipe Supports: PPIO with roller for 2-1/2 inch and smaller gas and conduit lines by Portable Pipe Hangers, Inc. PS-1-2 for 2-1/2 inch and larger gas lines by Portage Hangers, Inc. (800.797.6585).

C. Manufactured Step Platform: PPH Platform system as manufactured by Portable Pipe Hangers or approved equal. Grating material shall be 16 gauge steel with traction grip. Handrail shall be 12 gauge steel.

PART 3 - EXECUTION

3.01 PRE-MANUFACTURED COMPONENTS

A. Install roof system and flashings as specified.

B. At each location designated for step platform and pipe supports, install specified walkway protection pads. Place each unit in designated locations on walkway pads and adjust to necessary heights for adequate support and/or access.

C. Assemble step platform and pipe supports, per manufacturer requirements.

END OF SECTION 07 70 00

SECTION 07 79 10

FASTENING SYSTEMS FOR ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Furnish all labor, materials, equipment, and services to prepare and install the following:
   a. Insulation to Metal Deck
   b. Wood to Wood
   c. Wood to Steel
   d. Copper Sheet Metal to Wood
   e. Termination Bar/Counterflashing to Masonry or Concrete
   f. Wood to Concrete
   g. Wood Blocking to Masonry with Voids
   h. Metal to Metal
   i. Deck Plating/In-Fill Framing to Concrete

1.02 SUBMITTALS

A. Product data:

1. Submit manufacturer's latest descriptive literature, installation instructions and/or procedures to be followed during installation.
2. Published information verifying compatibility of products specified within this Section and substrate materials to which products will encounter.

B. Materials list:

1. List of 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.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site with packages and labels intact identifying manufacturer, product name and lot numbers when appropriate.

B. Store approved materials neatly in a suitable and designated area at the job site. Support materials off the ground and covered.

C. Use necessary means to ensure safe storage and use of material, as well as prompt and safe disposal of waste.

PART 2 - PRODUCTS

2.01 MATERIALS/MANUFACTURERS

A. Insulation to Metal Deck

B. Accepted Manufacturers:

1. Fasteners as available by roof Manufacturer for system warranty.
2. Roof grip screw with Climaseal coating; plastic disc or metal plate, by Buildex Division of ITW, Itasca, IL
3. Dekfast screw with Sentri coating; plastic disc or metal plate; by Construction Fasteners, Inc., Wyomissing, PA
4. Olympic #12-11 Standard Steel Deck Screw or #14-10 Heavy Duty All Purpose Screw with CR-10 coating; three inch diameter plastic or metal disc, by Olympic Manufacturing Group, Inc., Agawam, MA
5. Roofgrip screw with Climaseal coating; GAP metal discs, by Triangle Fastener Corp., Pittsburgh, PA

C. Screw Length: Sufficient to engage steel deck a minimum of 3/4 inch (engage on upper flange only)

D. Wood to Wood

1. General
   a. Type: Hot dip galvanized, common, annular ring nail.
   b. Length: Sufficient to penetrate underlay blocking 1-1/4 inch

2. Acceptable Manufacturers:
   a. Independent Nail, Inc., Bridgewater, MA
   b. W.H. Maze Co., Peru, IL
   c. National Nail Co., Grand Rapids, MI
   d. Hillwood Manufacturing Co., Cleveland, OH

E. Wood to Steel

1. Buildex #12 galvanized steel Traxx fastener with Climaseal finish or approved equal.
2. Length: sufficient to penetrate the metal deck one inch.

F. Copper Sheet Metal to Wood

1. Solid copper nails, 4d (1-1/2), 3/8 to 7/16 diameter flat head, diamond point, round barbed shank.
2. Length: sufficient to penetrate wood blocking 3/4 inch minimum or just through wood decking.

G. Termination Bar/Counterflashing to Masonry or Concrete

1. Tapcon 1/4 inch diameter, Phillips flat head anchor with EPDM washer, by Buildex Division of ITW, Itasca, IL
2. Kwik-Con II, 1/4 inch diameter fastener, by Hilti Corp., Tulsa, OK
3. Length: Sufficient to provide 1-1/4 inch embedment minimum.

H. Wood to Concrete

1. Confas screw, by Construction Fasteners, Inc., Wyomissing, PA
2. Con-Fixx screw, by Fabco Fastening Systems, West Newton, PA
3. Gripcon, by Gripcon Masonry Fastening, Albany, NY
4. Olympic (heavy duty screw), by Olympic Manufacturing Group, Inc., Agawam, MA
5. Tapcon 1/4 inch diameter, Phillips flat head anchor, by Buildex Div, of ITW, Itasca, IL
6. Kwik-Con II, 1/4 inch diameter fastener, by Hilti Corp., Tulsa, OK
7. Length: Sufficient to provide 1-1/2 inch embedment minimum.

I. Wood Blocking to Masonry with Voids

1. Masonry anchors shall consist of a two component polyester resin adhesive used in conjunction with a galvanized metal screen and Type 304 stainless steel threaded rod. Rod size shall be ½ inch diameter and 12 inches in length.
2. Acceptable Systems and Manufacturers
   a. Hilti Hit C-20 as supplied by Hilti Fastening Systems, Tulsa, OK.
   b. Approved substitute.

J. Metal to Metal

1. Zip screw with EPDM washer, by Tech Specialties
2. Length: sufficient to penetrate substrate by ½ inch.

K. Deck Plating/In-Fill Framing to Concrete

1. Plating: 3/8” by 2-1/4 inch hex head expansion sleeve anchors by Hilti Fastening Systems, Tulsa, OK.
2. Framing: 1/2” by 2-3/4 inch hex head expansion sleeve anchors by Hilti Fastening Systems, Tulsa, OK.

PART 3 - EXECUTION

3.01 AS DETAILED PER APPROPRIATE SECTION AND SCOPE OF WORK.

END OF SECTION 07 79 10

SECTION 07 79 20

FASTENING SYSTEMS FOR RESTORATION

PART 1 - GENERAL

1.01 SUMMARY

A. Work for this Section includes the following:

1. Furnish all labor, materials, equipment, and services to prepare and install fasteners, as required for attachment of various components of the Work.

1.02 SUBMITTALS

A. Product data:

1. Submit manufacturer's latest product data/literature, installation instructions, and other procedures to be followed during installation.
2. Published information verifying compatibility of products specified within this Section and substrate materials to which products will encounter.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site with packages and labels intact identifying manufacturer, product name and lot numbers when appropriate.

B. Store approved materials neatly in a suitable and designated area at the job site. Support materials off the ground and covered.

C. Use necessary means to ensure safe storage and use of material, as well as prompt and safe disposal of waste.

1.04 PROJECT CONDITIONS

A. Protect elements surrounding the work of this Section from damage or disfiguration.

PART 2 - PRODUCTS

2.01 GENERAL

A. Listed are the products and materials for the specified work. Provide all the incidental items and materials required to complete the Work in accordance with these documents.

B. Coatings for all fasteners and accessories, except as otherwise specified below: Hot dipped galvanized, ASTM A153, which does not fill the grooves of threaded items, except as otherwise required. Wood screws less than 1/4 inch diameter to have fluorocarbon coating with electroplated zinc base layer.

C. Use stainless steel fasteners and accessories for all fastening of and/or to preservative treated wood blocking and/or plywood.

D. Do not use powder-actuated fasteners.

2.02 MATERIALS

A. Concrete / Solid Masonry Substrate

1. Structural Steel to Concrete/Solid Masonry: Two component polyester resin adhesive used in conjunction with Type 304 stainless steel threaded rod. Rod size shall be 1/2 inch diameter with 4inch minimum embedment, such as HIT HY 200 by Hilti. Minimum edge distance in accordance with manufacturer's data.
2. Termination Bar/Light Gage Metal to Concrete/Solid Masonry: 1/4 inch diameter masonry/concrete screw fastener with 1-1/2 inch minimum embedment and weather-resistant coating, such as Tapcon by ITW Buildex. Minimum edge distance in accordance with manufacturer's data.

B. Hollow Masonry Substrate

1. Plywood / Metal Flashing / Termination Bar to Hollow Masonry Substrate: 1/4 inch diameter masonry/concrete screw fastener with 1-1/2 inch minimum embedment and protective coating, such as Tapcon by ITW Buildex.

C. Structural Steel Substrate

1. Wood / Metal Flashing / Metal Framing to Structural Steel (unexposed to weather): Self-drilling, self-tapping screw fastener, #12 diameter, length as required for threading to penetrate minimum 1/2 through steel member, with protective coating, such as Teks by ITW Buildex.
2. Structural Steel to Structural Steel: Bolts conforming to ASTM A325, Type 2 washers conforming to ASTM F436. Nuts conforming to ASTM A563.

PART 3 - EXECUTION

3.01 GENERAL

A. Install all fasteners straight and true.

B. Install all fasteners following the manufacturer's written recommendations. Pre-drill pilot holes in substrates as required, such as masonry and concrete.

C. Install all fasteners to the specified minimum embedment, unless otherwise indicated in the Specifications or Drawings.

D. Reference associated technical sections for addition installation instructions, including requirements for the materials being fastened/attached.

E. Install all fasteners with integral EPDM washers in accordance with manufacturer's recommendations for torque control driving tools.

3.02 EXPOXY ANCHOR INSTALLATION

A. Establish dowel locations as shown on the Drawings. Use string lines and other leveling devices to ensure proper horizontal and vertical placement.

B. Drill holes to the specified depth as indicated on the approved Drawings. Unless otherwise noted, holes shall be 1/16 inch larger in diameter than the anchor to be used; e.g., 9/16 inch diameter holes for 1/2 inch diameter anchors.

C. Clean holes of all dust and debris, using vacuum cleaner, compressed air free of oil, and a stiff, cylindrical nylon bristle brush of sufficient length to clean the full depth of the hole in the back-up. Alternate application of compressed air and clearing hole with brush, until neither operation produces any dust. Do not use metal wire brushes to clean holes.

D. Load two-part epoxy cartridge into double-barrel caulking gun. Remove cap on cartridge and verify that the two components of epoxy have not been contaminated at the end of the tube. Discard any hardened, partially-hardened, or partially mixed epoxy. Attach static mixing head to tip of epoxy cartridge, using nut supplied by manufacturer. Pump epoxy into waste container until both components are fully mixed and epoxy is a uniform color, is not "marbled," and does not contain any light or dark streaks of one or the other unmixed component when pumped from the end. Pump additional epoxy for two more full squeezes on the gun to ensure complete mixing at tip.

E. At hollow units, insert screen into hole.

F. Insert the mixing tip into the hole. Starting from the rear, fill hole with epoxy until one-half to two-thirds full.

G. Insert anchors of appropriate lengths into the center of the holes. Gently push the anchors into the epoxy to the bottom of the hole in the masonry. As the anchor is pushed into the masonry, slowly rotate anchor counterclockwise.

H. Do not disturb anchor between the specified gel and cure time.

I. Anchors in epoxy that do not cure properly must be abandoned and replaced with new anchors. Holes and threaded rod with failed epoxy cannot be reused and must be discarded and replaced. After epoxy manufacturer's specified cure-time for current environmental conditions, check that epoxy in the masonry has cured by performing the following test:

1. Probe the epoxy in the hole with a No. 9 stainless steel wire, checking for any softness in the epoxy. If the wire makes a depression in the epoxy, replace the anchor at no cost to the Owner. Install new anchor at least 3 inch away from the abandoned anchor.

3.03 ADJUSTING AND CLEANING

A. Clean site of all unused materials and waste in accordance with environmental regulations.

B. Remove and dispose of all materials used to protect surrounding areas and building surfaces, following completion of the work of this Section.

C. Repair, restore, or replace all materials, landscaping, interior finishes, and surfaces damaged by the Work to the satisfaction of the Owner at no additional expense.

END OF SECTION 07 79 20

SECTION 07 92 10

JOINT SEALANTS FOR ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Furnish all labor, materials, equipment and supervision to install in accordance with the specifications and drawings all items listed, but not limited to:
   a. Sealant at Sheet Metal Coping Joints.
   b. Sealant at Surface Mounted Wall Counterflashing.
   c. Sealant at Reglet Counterflashing Wall Interface.
   d. Sealant at Base Flashing Terminations.
   e. Pourable Sealer for Penetration Pockets.
   f. Sealant at Masonry Joints.

1.02 PERFORMANCE REQUIREMENTS

A. General Performance: Installed sealant materials shall withstand specified pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Material Compatibility: Provide sealant materials that are compatible with one another under conditions of service and application required.

1.03 SUBMITTALS

A. Product Data:

1. Submit Manufacturer's latest descriptive literature for each type of sealant materials as specified.
2. Reports for tests made within three years of the submittal date showing compliance with ASTM C920, and the standards C920 references, including C793 and C719, using the substrates and procedures contained in this Section.
3. Pre-installation Compatibility and Adhesion Testing: Test elastomeric sealants and accessories with samples of each joint substrate material for compatibility, adhesion, and freedom from staining. Include recommendations for substrate preparation and primers for proper adhesion, and solvents for cleaning.

4. Field reports from the sealant manufacturer representative for periodic site visits made to review the work in-progress. The field report should provide information regarding type of work in-progress during the visit, whether the meets manufacturer guidelines and the requirements of this Section, recommendations for future work, and required repairs/corrections (if any). The field report should also include results and comment from "in-progress" field adhesion testing of sealant previously installed.

B. Materials List:

1. List of 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.

C. Manufacturer's Information:

1. Installation Instructions: Submit special procedures for perimeter conditions requiring special attention.
2. Manufacturer's Certificate: Certify submitted products meet or exceed specified requirements.
3. Manufacturer's recommendations for adhesive and chemical compatibility based on laboratory test with job-site materials. Laboratory test reports from the sealant manufacturer for adhesion-in-peel tests showing adequate adhesion to the various substrates used on this project before and after 7 days water immersion, along with the manufacturer's recommendations for cleaning and priming each substrate.

1.04 QUALITY ASSURANCE

A. Qualifications: Not less than five (5) years successful experience with comparable projects and employing personnel that are skilled in specified work of this Section.

B. Regulatory Requirements: Properly dispose of all waste materials resulting from this work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Sealant materials are to be provided from one manufacturer to maintain consistent quality and color. Provide accessory materials recommended by the sealant manufacturer, pending approval by the Owner and Consultant, based on job-site adhesion testing.

B. Deliver and store materials on job site in a manner that prevents damage, contamination or breakage and with packages intact displaying labels identifying manufacturer, product name, and lot numbers when appropriate.

C. Store materials in accordance with manufacturer's recommendations. Comply with manufacturer's recommendations for minimum and maximum time and temperature limits for storage. Protect liquid components from freezing.

D. Store flammable materials in a cool dry, protected area away from sparks and open flames.

E. Materials shall be marked with the date of manufacture and shelf life. Do not use products beyond the expiration of their shelf life.

1.06 SITE CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions;

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less or more than those allowed by joint-sealant manufacturer for applications specified.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

B. Do not proceed with installation of new sealants during threatening or unfavorable weather conditions. If sealant work cannot be performed, provide the necessary protection to keep building watertight.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Listed are primary products and materials for the specified repair work. Provide all incidental items and materials required for completion of the work in accordance with these documents.

B. Sheet Metal

1. FS TT-S-00230C (2), single component, gun grade, non-sag urethane or polyether sealant.
   a. Vulkem 116 by Mameco
   b. Dynatrol I by Pecora
   c. Sonolastic NP 1 by Sonneborn
   d. Dymonic by Tremco
   e. Sikaflex-1a by Sika Corp.

C. Masonry Joints

1. FS TT-S-00227E (3), Type II, Class A; multi-component, non-sag polyurethane sealant.
   a. Dynatrol II by Pecora Corp.
   b. Sikaflex-2c NS by Sika Corp.
   c. Sonolastic NP 2 by Sonneborn
   d. Dymeric 511 by Tremco, Inc.

D. Non-exposed compression sealant

1. TT-S-001657, Type I single component, low viscosity, self-wetting, butyl blend mastic.
   a. Butyl Sealant by Tremco, Inc.
   b. Water Block Seal by Firestone Building Products
   c. Water-Cut Off Mastic by Carlisle Syntec

E. Silicone Sealant:

1. Single component formulation with low modulus, high elongation characteristics, capable of obtaining strong, durable bond to the building substrate.
   a. Intended Use: Provide as the primary sealant for weatherproofing exterior joints.
   b. Color: To match adjacent surfaces, or as selected by the Owner, based on custom colors.
   c. Approvals: Must meet adhesion and stain testing requirements, as well as compatibility with applied surfaces.
   d. Acceptable Product Manufacturers:
      1) Dow Corning Corporation, Midland, MI.
      2) GE Silicones, Waterford, NY.
   e. Established Standard for Acceptable Products:
      1) Building/Perimeter Joints: Dow Corning 790.
      2) Metal Joints: Dow Corning 123 & 795.

2. High Temperature Silicone Sealant
   a. Established Standard for Acceptable Products:
      1) Dow Corning 732
      2) Dow Corning 734
      3) Dow Corning 736

F. Primer:

1. Test application of sealants to intended surfaces. If testing indicates a need for primer, provide the type recommended by the sealant manufacturer.
2. Substrates surfaces must be primed unless specifically excluded by the sealant manufacturer or demonstrated otherwise by field adhesion testing.
3. Provide the appropriate primer from the sealant manufacturer for each substrate condition encountered.
4. Verify compatibility of primer with wall finishes prior to application.

G. Backer Rod:

1. Type: Compressible foam compatible with sealant and as approved by sealant manufacturer.
2. Acceptable Product: "Soft-Rod", manufactured by NMC Corporation.
3. Installation: Sized and shaped to control depth of sealant.

H. Bond Breaker Tape:

1. Type: Pressure sensitive adhesive polyethylene tape as recommended by sealant manufacturer.

2. Use: Apply bond breaker tape at those locations where two-sided sealant adhesion is required, and where a backer rod cannot be installed.
3. Thickness: 0.006 inch (6 mil)
4. Width: As required for application.

I. Miscellaneous Materials:

1. Joint Cleaner: Clear, clean solvent-type cleaners, as recommended or required by the sealant manufacturer. Test the compatibility of joint cleaner on existing surfaces.
2. Shop Cloths: Use shop cloths or clean, lint-free rags for joint cleaning operations.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine existing conditions in the area of work and verify that no conditions are present that prevent or otherwise interfere with the installation of the specified work.

B. Adverse conditions are to be reported in writing within three calendar days upon identification. Absence of such notification will constitute the Contractor's acceptance of existing conditions.

C. Before ordering materials or performing work, obtain and verify all measurements at the project site. Exact measurements are the Contractor’s responsibility.

3.02 PREPARATION

A. General

1. Cut out and completely remove existing sealants, backer rods, etc., prior to installing new materials.
2. Saw-cut existing building/perimeter masonry joints as required to provide a minimum joint width of 1/4 inch, or as recommended by the sealant manufacturer. At masonry control/expansion joints less than 3/8 inch wide, saw-cut to provide minimum 1/2 inch width.
3. Saw-cut existing mortar joints as required to provide a minimum 1/4 inch depth to receive sealant, or as recommended by the sealant manufacturer. If existing mortar is damaged or degraded, tuck-point in accordance with Section 04500 prior to caulking.
4. Coordinate removal and new caulking efforts so that existing building joints do not remain open at the end of each workday.

B. Masonry Cracks:

1. Inspect the condition of masonry cracks with the Owner's Representative.

2. Regard cracks as dynamic (where movement will routinely occur), unless conditions indicate otherwise. Saw-cut cracks to provide a 1/4 inch (masonry joints/corners) wide joint opening and an appropriate depth to receive backer rod and sealant materials.

C. Joint Cleaning:

1. Thoroughly clean joint surfaces which are to receive new sealant, removing all foreign matter, dust, oil, grease, water, surface dirt, old sealant and existing paint or primer.
2. Remove all loose particles, residual dust, or other foreign substances by blowing out joints with oil free compressed air prior to application of primer or sealant.
3. Clean metal surfaces by a solvent that leaves no residue, such as toluene or xylene. Use clean, white cloths or lint-free paper towels for cleaning with solvent and drying.
4. Mask areas adjacent to joints as required to protect adjacent surfaces.

D. Primer:

1. Apply primer to surfaces in accordance with the sealant manufacturer's instructions.
2. Apply primer with a clean, dry, lint-free cloth. Do not dilute materials. Flooding of the substrate surface with primer is not permitted. Confine primer to areas of sealant bond only.

E. Backer Rod:

1. Provide backer rod with a minimum diameter that is 25 percent greater than the joint width. Install backer rod with a blunt instrument. Replace any punctured or twisted rods.
2. Install backer rod to control depth of sealant from 1/4 to 1/2 inch, as measured at the outboard face.
3. Do not leave gaps between ends of backer rods.
4. Where backer rods must terminate, use bond breaker tape.

F. Bond Breaker Tape:

1. Install bond breaker tape at active working joints or cracks, which cannot be routed or otherwise modified to accommodate a backer rod.
2. If the use of a bond breaker tape is not feasible, other methods of achieving a bond break may be permitted upon approval by the Consultant.

3.03 INSTALLATION

A. General:

1. Comply with the manufacturer's requirements for correct sizing and installation of sealant with respect to anticipated joint movement and material temperatures.
2. Masking: Apply masking tape along joints in areas of high visibility or areas where the appearance of sealant on wall/glass surfaces is objectionable.
3. Joint Design:

a. Sealant bead depth should be less than the joint width. Maintain a 2:1 ratio of joint width to sealant depth in accordance with the manufacturer's requirements.
b. For joint widths greater than 1 inch, submit installation recommendations from the manufacturer for approval by the Consultant.

4. Methods:
   a. Apply sealants using a cartridge-type caulking gun or bulk-loading gun, following the manufacturers written instructions.
   b. Apply sealants in a continuous operation to eliminate air voids throughout the entire joint cross-section.

5. Finishing:
   a. Tool or strike the sealant joint to a concave profile with a light pressure to spread the material against the back-up material and ensure adhesion to joint surfaces.
   b. Complete tooling in one continuous stroke within 10 minutes of sealant application and before skin forms. Perform dry tooling only. The use of soaps, oils, water and/or alcohols as tooling aids are not permitted.
   c. If masking materials are used, remove immediately after tooling the sealant.

B. Outdoor lights, signs, and wall penetrations: Provide weather tight application of new elastomeric sealant at all other conditions and penetrations through exterior walls.

3.04 FIELD QUALITY CONTROL

A. Make provision to assist and coordinate progress reviews of the work by the Consultant.

B. Field Adhesion Tests of Sealants: After work commences, perform sealant adhesion tests at representative locations as directed by the Consultant, using methods approved by the sealant manufacturer. Replace any sealant that fails to develop proper adhesion.

3.05 CLEANING

A. Remove excess sealant or other soiling due to caulking operations on adjacent surfaces as the work progresses.

B. On non-porous surfaces, remove excess sealant and clean with xylene or mineral spirits before the sealant cures.

C. On porous surfaces, allow excess sealant to cure and then remove by light abrasion or other mechanical means.

D. Leave finished work in neat, clean condition with no evidence of spills onto adjacent surfaces.

3.06 PROTECTION

A. Protect sealed joints from being disturbed for a minimum of 48 hours.

END OF SECTION 07 92 10

SECTION 07 92 20

JOINT SEALANTS FOR RESTORATION

PART 1 - GENERAL

1.01 SUMMARY

A. Provide labor, materials, equipment and incidentals required for restoration of joint sealants and window glazing systems.

B. Work for this Section includes the following:

1. Remove existing sealants, where present. Remove all remnants of existing sealants from substrates.
2. Prepare, clean and prime the substrates scheduled to receive sealant.
3. Provide backing materials (backer rod or release tape) at joint locations.
4. Provide sealant.
5. Areas of sealant replacement / application include, but are not limited to:
   a. Masonry expansion joints.
   b. Precast concrete panels joints.
   c. Perimeter of system penetrations (such as pipe).
   d. Window, louver, door, and other wall opening perimeters.
   e. Glazing perimeters (wet seals).
   f. Window framing joints.
   g. Metal coping flashing seams
   h. Miscellaneous joints indicated in the Specifications and Drawings.

C. Sealant materials are to be provided from one manufacturer. Provide accessory materials as required or recommended by the sealant manufacturer.

D. Comply with manufacturer's requirements for correct sizing, selection and installation of building sealants with respect to joint movements, construction material temperatures, and weather conditions at the project site.

E. All new materials are to be interfaced with, and integrated into, existing materials to provide completed work that is sound, aesthetically acceptable, and weathertight.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C 661: Test Method for Indentation Hardness of Elastomeric - Type Sealants by Means of Durometer Hardness; Shore "A".
2. ASTM C 679: Standard Test Method for Tack-free time of Elastomeric Sealants.
3. ASTM C 719: Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement (Hockman Cycle).

4. ASTM C 793: Standard Test Method for Effects of Accelerated Weathering on Elastomeric Joint Sealants
5. ASTM C 920: Elastomeric Joint Sealants.
6. ASTM C 1184: Structural silicone sealants.
7. ASTM C 1523: Determining Modulus, Tear and Adhesion Properties of Pre-cured Elastomeric Joint Sealants.
8. ASTM D412: Vulcanized Rubber and Thermoplastic Elastomers – Tension.

B. Federal Specification:

1. Federal Specification TT-S 001 543 A (COM-NBS) Class A for silicone building sealants.
2. Federal Specification TT-S-00230C (COM-NBS) Class A for one-component building sealants.

1.03 SUBMITTALS

A. Product Data:

1. Manufacturer's published data indicating that furnished materials comply with the project requirements and are suitable for applications shown.
2. Manufacturer recommended sealants, primers and cleaners for specified joint conditions.
3. Shop Drawings: Upon request, provide joint details with appropriate manufacturer's approval.
4. Written explanation to decipher code numbers used on material containers to record manufacturing dates.
5. Reports for tests made within three years of the submittal date showing compliance with ASTM C920, and the standards C920 references, including C793 and C719, using the substrates and procedures contained in this Section.
6. Manufacturer's recommendations for adhesive and chemical compatibility based on laboratory tests with job-site materials. Laboratory test reports from the sealant manufacturer for adhesion-in-peel tests showing adequate adhesion to the various substrates used on this project before and after 7 days water immersion, along with the manufacturer’s recommendations for cleaning and priming each substrate.
7. Field reports from the sealant manufacturer representative for periodic site visits made to review the work in-progress. The field report should provide information regarding type of work in-progress during the visit, whether the work meets manufacturer guidelines and the requirements of this Section, recommendations for future work, and required repairs/corrections (if any). The field report should also include results and comments from “in-progress” field adhesion testing of sealant previously installed.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: Not less than five (5) current years relevant successful experience with comparable projects and employing personnel skilled in the Work specified in this Section. The skilled person shall have at least five (5) years of experience and shall have successfully completed at least two (2) projects within the past three (3) years involving quantities and complexities similar to those required under this Section

B. Manufacturer Qualifications: Not less than twenty (20) years successful experience with the production and sales of the sealants intended for Work of this Section.

C. Source of Materials: Obtain materials from a single source for each type required to ensure quality, color, pattern, match, and texture.

D. Regulatory Requirements: Properly dispose of all waste materials resulting from this work.

E. Field Samples:

1. Field-Constructed Samples: At least two weeks prior to the start of the sealant work, provide samples of sealant joints on the building where directed by the Consultant. Notify the Consultant at least seven days before construction of the sample, so that a representative may be present during the construction of the sample. Do not start work until the Consultant has approved the field sample and field adhesion testing (see below). Sample must be aged 14 days and cleaned before being reviewed for approval. Provide sealant joints as required to meet the field sample requirements specified in other Sections.
2. Field Adhesion Testing
   a. Notify the Consultant at least seven (7) days prior to sealant application for field adhesion testing and at least seven (7) days prior to pull-testing so that a representative can be present during both operations. Failure to notify the Consultant constitutes failure of the samples tested. Work installed without notifying the Consultant may be rejected.
   b. At least six (6) weeks prior to the start of sealant installation, apply specified sealants to each job site substrate following specified procedures. Construct three (3), 10 inch long x 1/2 inch wide x 1/2 inch deep sealant joints against each substrate. Apply bond breaker tape to the substrate surface under the last 2 inches of the sealant at each end of the strips and joints to provide a tab for testing after curing. Prepare surface (including cleaning and priming) and install sealant joints and strips as described below and as will be done during the general sealant installation.
   c. Pull-Testing: After curing for 14 days at prevailing outdoor temperatures, grasp the 2 inch tabs on the ends of the joints and the strip samples and pull the sealant at 90º to the surface.
   d. With acceptable applications, the sealant shall fail cohesively (tearing within itself) with no adhesive (debonding) failure.
   e. If any sample debonds from the substrate, the sealant manufacturer shall make recommendations regarding changes in surface preparation or primers and submit these recommendations to the Consultant for approval. Repeat field adhesion tests using approved recommendations.

f. Repeat sealant adhesion tests as many times as required to produce an acceptable application at no additional cost to the Owner. Acceptable application required prior to full scale sealant installation.

3. Rebuild samples as many times as required to meet the Consultant's approval at no additional cost to the Owner or delay in the project schedule. Keep approved sample areas in a cleaned and finished condition throughout the duration of the project. Reproduce samples accurately in construction using identical materials, mixtures, and quality of workmanship. Mock-ups will be used to measure standards of workmanship and completed work, including finish, texture, and color.
4. Do not proceed with field samples until all materials have been submitted and approved.

F. Pre-Installation Conference: Prior to commencing work of this Section, meet with the Owner and Consultant to discuss sequencing and installation procedures.

1.05 DELIVERY, STORAGE AND HANDLING

A. Sealant materials are to be provided from one manufacturer to maintain consistent quality and color. Provide accessory materials recommended by the sealant manufacturer, pending approval by the Owner and Consultant, based on job-site adhesion testing.

B. Deliver and neatly store materials on job site in a manner that prevents damage, contamination or breakage and with packages intact displaying labels identifying manufacturer, product name, and lot numbers when appropriate.

C. Store materials in accordance with manufacturer's recommendations. Comply with manufacturer's recommendations for minimum and maximum time and temperature limits for storage. Protect liquid components from freezing.

D. Store flammable materials in a cool dry, protected area away from sparks and open flames.

E. Materials shall be marked with the date of manufacture and shelf life. Do not use products beyond the expiration of their shelf life.

1.06 PROJECT CONDITIONS

A. Protect elements surrounding the work of this Section from damage or disfiguration.

B. Do not proceed with installation of joint sealants under the following conditions;

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less or more than those allowed by joint-sealant manufacturer for applications specified.

4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

C. Do not proceed with installation of new sealants during threatening or unfavorable weather conditions. If sealant work cannot be performed, provide the necessary protection to keep building weathertight.

1.07 WARRANTY

A. Reference Section 01 78 00 – Project Closeout and Warranties.

PART 2 - PRODUCTS

2.01 GENERAL

A. Listed are the products and materials for the specified work. Provide all incidental items and materials required to complete the Work in accordance with these documents.

2.02 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: Match existing building sealant.

2.03 ELASTOMERIC JOINT SEALANTS

A. Single-Component Neutral-Curing Silicone Sealant:

1. Type: Elastomeric sealant with low modulus, high elongation characteristics, capable of obtaining strong, durable bond to the building substrate. Neutral-cure silicone sealant meeting ASTM C920, Type S, Grade NS, Class 25, that is SWRI approved.
2. Intended Use: Provide as the primary sealant for weatherproofing exterior joints including perimeter joints, and new control / expansion joints. Provide as the primary sealant for weatherproofing window joints, window glazing, flashings, etc.
3. Approvals: Must meet adhesion and stain testing requirements, as well as compatibility with applied surfaces.
4. Acceptable Products:
   a. Building/Perimeter Joints: Dow 790 by Dow Corning, or approved equal.
   b. Window Glazing/Frame/Flashing Joints: Dow 795 by Dow Corning, or approved equal.

B. Polyurethane Sealants

1. Non-sag Polyurethane Sealant:
   a. Type: Elastomeric sealant with low modulus, high elongation characteristics, capable of obtaining strong, durable bond to the substrate that is SWRI approved.
   b. Intended Use: Provide for sealing cracks or joints in concrete or precast prior to application of elastomeric coating..
   c. Approvals: Must meet adhesion and stain testing requirements, as well as compatibility with applied surfaces.
   d. Acceptable Products: MasterSeal NP-1.

C. Precured Silicone Seal:

1. Type: Preformed, ultra-low modulus silicone flashing.
2. Intended Use: Cover transverse joints in window frame.
3. Approvals: Must meet adhesion and stain testing requirements, as well as compatibility with applied surfaces.
4. Acceptable Products:
   a. Dow Corning 123, bonded with Dow Corning 795 sealant, or approved equal.

5. Size: Verify in Field

D. Preformed Tape Sealants:

1. Back-bedded Mastic Tape Sealant: Preformed, butyl-based elastomeric tape sealant; nonstaining and nonmigrating in contact with nonporous surfaces;
2. Approval:With or without spacer rod as recommended in writing by tape manufacturers for application.
3. Intended use:
   a. For applications where tape is subject to continuous pressure, AAMA 806.3 Tape.
   b. For applications where tape is not subject to continuous pressure, AAMA 807.3 Tape.

2.04 JOINT-SEALANT BACKING

A. Backer Rod:

1. Type: Closed-cell, polyethylene rod. The diameter of the rod is to be approximately 25% greater than joint width except quarter round or triangular rod (for fillet joints) which shall not be over-sized. Surface skin of rod shall be continuous and unbroken and of sufficient thickness to preclude outgassing and formation of voids in the overlying sealant.
2. Acceptable Product:
   a. HBR by Nomaco
   b. Kool-Rod by W.R. Meadows

3. Installation: Sized and shaped to control sealant depth and otherwise contribute to producing sealant performance.

B. Bond Breaker Tape:

1. Type: Pressure sensitive adhesive polyethylene tape to which sealant does not bond, as recommended by sealant manufacturer.
2. Use: Apply bond breaker tape at those locations where two-sided sealant adhesion is required, and where a backer rod cannot be installed.
3. Thickness: 0.006 inch (6 mil.)
4. Width: As required for application.

2.05 ACCESSORIES

A. Primer:

1. All substrate surfaces must be primed, except glass; no exceptions.
2. Provide primers recommended by the sealant manufacturer for the specific job-site substrate(s).
3. Verify compatibility of primer with wall finishes prior to application.

B. Joint Cleaner: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote adhesion of sealants to joint substrates. Test the compatibility of joint cleaner on existing surfaces.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

D. Shop Cloths: Use shop cloths or clean, lint-free rags for joint cleaning operations.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine existing conditions in the area of work and verify that no conditions are present that prevent or otherwise interfere with the installation of the specified work.

B. Adverse conditions are to be reported in writing within three calendar days. Absence of such notification will constitute the Contractor's acceptance of existing conditions.

C. Before ordering materials or performing work, obtain and verify all measurements at the project site. Exact measurements are the Contractor’s responsibility.

3.02 PREPARATION

A. General:

1. Cut out and completely remove existing sealants, backer rods, etc., prior to installing new materials.
2. Saw-cut existing masonry to widen joint if necessary as determined by requirements in Section 04 43 00 – Masonry Restoration.
3. Coordinate sealant removal and replacement efforts so that existing building joints do not remain open at the end of each work day.
4. Where joints extend below grade, remove soil to allow caulking of entire joint length. Aside from soil removal all cleaning and installation instructions remain the same.

B. Joint Cleaning: Clean out joints immediately before installing joint sealants to comply with sealant manufacturer's written instructions, except as modified below:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing bond with joint sealants. Remove loose particles remaining after cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Solvent clean all surfaces to receive sealant, following the manufacturer's recommendations. Protect adjacent building envelope components from exposure to the cleaners.
3. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Protect adjacent building envelope components from exposure to the cleaners.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION

A. Install sealant backing materials to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow sealant movement capability.

1. Unless noted otherwise, install clean, dry backer rod, quarter round rod, or bond break tape, in or over all joint openings against dry substrates. Remove all wet materials from the job site. Replace any backer rod not sealed over by the end of each day and solvent clean surfaces again.

2. Change rod sizes as frequently as required by the variation in the joint width. Do not twist rods together. Butt ends of rods tightly. Provide a full range of rod sizes at the site of all sealant work.
3. Do not touch with fingers or otherwise contaminate the substrate surfaces while inserting the backer rod or bond breaker tape.
4. Do not rupture the skin of the closed cell backer rod during installation. Do not cut rod lengthwise as substitute for smaller diameter rod. Remove any rod containing punctures and solvent clean the surfaces again.

B. Apply primer to all substrates, except glass, after backing material installation. Apply primer to clean, dry substrates at ambient temperatures above 45°F.

1. Do not dilute materials.
2. Pour primer into a clean container for use. Do not pour more than a ten-minute supply into container to prevent deterioration.
3. Replace cap on primer can immediately after pouring. Remove from the site any primer that contains a white precipitate or that has thickened.
4. Apply primer with a clean brush or dry lint-free cloth. Do not apply primer to exposed surfaces beyond sealant. Confine primer to areas of sealant bond only; do not allow spillage or migration onto adjoining surfaces. Mask all surfaces before priming, except where surface irregularities will allow the primer to wick beneath the masking tape.
5. Use only one coat of primer. Do not apply primer in a thick layer, which will form a white, powdery film. Flooding of the substrate surface with primer is not permitted. Remove any films with a clean, dry, lint-free cloth and repair in accordance with manufacturer's written recommendations.
6. Allow primer to dry. Do not allow primer to become wet before sealant application.

C. Joint Design:

1. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow sealant movement capability.
2. For joint widths greater than 1 inch, submit installation recommendations from the manufacturer for approval by the Consultant.
3. For typical butt sealant joints, place the backer rod or bond breaker so the sealant depth measured at the center of the joint after tooling is one-half of the sealant joint width, with a min. depth of 1/4 inch and a maximum depth of 1/2 inch.
   a. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

4. At fillet (triangular) joints, extend the sealant at least 3/8 inch onto the substrate beyond the bond breaker tape or backer rod and at least 5/8 inch onto the substrate perpendicular to the tape or rod. The minimum thickness between the edge of the tape or rod and surface of the sealant joint shall be at least 1/4 inch.
5. Avoid three-sided adhesion at all sealant joints.
6. Do not prepare or seal over masonry that is less than 21 days old or was pointed within 21 days.

D. Application

1. Inspect each cartridge or container of sealant before use and verify that the production date is within six months of the date of application. Remove from the site all sealant more than six months old. Each applicator shall understand the method of coding the production date on the cartridge.
2. Mask all exposed surfaces, not masked for priming, along joint before applying sealant.
3. Recheck correct backer rod and bond breaker tape positioning before applying sealant.
4. Apply sealant only to clean, dry, primed surfaces (where required) at ambient temperatures above 45°F. Seal joints within 10 hours of primer application.
5. Fill all joints solidly and continuously with sealant, neatly applied with a standard caulking gun in a continuous motion, using a slight pressure. "Push" the sealant bead ahead of the nozzle; do not "drag" the nozzle.
6. Within five minutes of sealant application and before skin develops on sealant, dry tool the joint surface with a concave tool to insure intimate contact with substrate and to eliminate air bubbles. The use of soaps, oils, water and/or alcohols as tooling aids is not permitted. Provide a smooth, uniform finished surface with indicated profile.
7. Mate joints formed from different colored sealants before skin forms on the sealant.
8. Remove masking tape within ten minutes of tooling. Avoid contaminating adjacent surfaces with excess sealant. Remove all traces of smears and droppings on metal or glass surfaces promptly, using a solvent recommended by the sealant manufacturer that will not damage or discolor the building surfaces. Remove smears and droppings on porous surfaces by mechanical means after the initial cure of the sealant. Remove excess sealant from surfaces adjacent to joints.
9. Coordinate work with other trades to prevent contamination of fresh sealant by dust or other debris.

E. Precured Silicone Seal

1. Clean and prime all surfaces to receive sealant as specified above. Apply a bead of bonding sealant on each side of the joint to be covered with preformed silicone flashing. Bead shall be 1/4 inch for rough surfaces and 1/8 inch for smooth surfaces. For severely rough surface, additional sealant may be required to fill valleys. The bead of sealant applied should provide a bonding area of at least 1/2 inch wide when the flashing is applied.
2. Within 10 minutes from application of the sealant beads, press the preformed flashing into the wet sealant and back-up substrate. Set the flashing uniformly in place using hand-pressure or a hand roller.
3. Overlap end laps at least 1 inch.
4. At corners and other transitions, overlap adjacent section the entire width. Ensure the sealant bead is continuous at exposed ends to prevent water infiltration.
5. Install preformed flashing over horizontal joints before vertical joints. Cut ends of horizontal joints so that the horizontal joint flashing extend under the vertical joints flashing (to be installed after) 1/4 inch.

F. Installation of Preformed Tapes:

1. Install according to manufacturer's written instructions.

G. Exterior Window Glazing/Frames/Flashing:

1. If existing glazing gasket is severely deteriorated, trim as required. Otherwise, leave existing gaskets intact. Reinstall any gaskets that may be loose or displaced from window frames.
2. Clean surfaces as specified.
3. Apply a fillet bead of silicone sealant between the metal window stops and adjacent glass surfaces. The fillet bead is to be continuously formed on all sides of each lite, providing two-sided adhesion between glass and metal frames. Use masking tape as needed to maintain an even and uniform sealant bead along glass site lines.
4. Apply silicone sealant at each exterior window frame and metal flashing joint to provide a continuous, weathertight seal. Adjust sealant bead sizes corresponding to the size of the underlying joint.
5. Apply bond breaker tape over working joints prior to sealant application.
6. Do not seal weep holes, unless noted otherwise or advised.
7. Apply silicone sealant over existing screw fastener heads in the window frame.

H. Outdoor Lights, Signs, and Wall Penetrations: Provide weathertight application of new elastomeric sealant at all other conditions and penetrations through exterior walls.

3.04 FIELD QUALITY CONTROL

A. Make provision to assist and coordinate progress reviews of the work by the Consultant.

B. During project sealant application, test adhesion of exterior perimeter sealant joints at 30%, 60%, and 90% sealant completion. Three weeks after installation, cut a tab on a joint and test adhesion. Patch test areas in accordance with manufacturer's instructions. If application is not acceptable to the Consultant, conduct additional test as directed by the Consultant.

C. Remove excess sealant or other soiling due to caulking operations on adjacent surfaces as the work progresses by methods and materials approved in writing by manufacturers of joint sealants.

3.05 ADJUSTING AND CLEANING

A. Clean site of all unused materials and waste in accordance with environmental regulations.

B. Remove and dispose of all materials used to protect surrounding areas and building surfaces, following completion of the work of this Section.

C. Repair, restore, or replace all materials, landscaping, interior finishes, and surfaces damaged by the Work to the satisfaction of the Owner at no additional expense.

3.06 PROTECTION

A. Protect sealed joints from being disturbed or contaminated for a minimum of 48 hours, unless more stringent requirements apply.

END OF SECTION 07 92 20

SECTION 08 52 00

ALUMINUM WINDOWS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, equipment, and incidentals required to furnish and install aluminum windows complete with hardware and related items specified in this section.

B. Work for this Section includes, but is not limited to, the following:

1. Field measure all window openings.
2. Prepare and submit shop drawings prior to ordering the windows.
3. Remove and dispose of existing wood frame window and iron bars. Demolition shall be in accordance with the general requirements for demolition work specified in Section 02 42 20 – Selective Demolition for Restoration. Provide temporary protection to keep the building weathertight until new windows are installed.
4. Except as noted, provide fixed windows including all framing, glass, glazing, sill flashing, trim, closures, and accessories as shown on the shop drawings.
5. Repair damaged interior and exterior finishes caused by the work. Repair finishes to finish-coat ready condition.
6. Provide field samples as required in this section.
7. Field testing of mockup installations and of actual installations during construction.
8. Clean the interior and exterior window surfaces after all work has been completed.

C. All new materials are to be interfaced with, and integrated into, existing materials to provide completed work that is sound and weathertight.

1.02 REFERENCES

A. All standards referenced are latest editions, unless otherwise indicated.

B. American Architectural Manufacturer Association (AAMA):

1. AAMA 101: Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.
2. AAMA 910: Voluntary "Life Cycle" Specifications and Test Methods for Architectural Grade Windows and Sliding Glass Doors.
3. AAMA 1502.7: Voluntary Test Method for Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
4. AAMA 1503.1: Voluntary Test Method for Thermal Transmittance of Windows, Doors, and Glazed Wall Sections.
5. AAMA 1503: Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
6. AAMA 2603: Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

7. AAMA 2604: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
8. AAMA 2605: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
9. AAMA CW-10-04: Care and Handling of Architectural Aluminum from Shop to Site.

C. American Society for Testing and Materials (ASTM)

1. ASTM C 1036: Standard Specification for Flat Glass.
2. ASTM C 1048: Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
3. ASTM C 1087: Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
4. ASTM E 283: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
5. ASTM E 330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
6. ASTM E 331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
7. ASTM E 547: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Cyclic Static Air Pressure Differential.
8. ASTM E 1017: Standard Specification for Generic Performance Requirements for Exterior Residential Window Assemblies.
9. ASTM E 2190: Standard Specification for Insulating Glass Unit Performance and Evaluation.

D. Glass Association of North America (GANA): "Glazing Manual" and "Sealant Manual."

E. NFRC – National Fenestration Rating Council: NFRC 100-04 “Procedure for Determining Fenestration Product U Factors”.

F. Consumer Products Safety Commission (CPSC): 16 CFR 1201.

G. American National Standards Institute (ANSI): ANSI Z97.1

H. National American Fenestration Standard (NAFS): NAFS-08

1.03 SYSTEM DESCRIPTION

A. AAMA Designation:

1. Fixed: AW-PG70-FW

B. Windows: Minimum 2-1/2" frame depth; extruded aluminum with integral structural glass-reinforced nylon 6/6 thermal break; equal-leg frame; finish factory-applied; factory-assembled.

C. Configuration:

1. Fixed

D. Fixed glazing: 100% silicone; 1" insulating glass; foam filled bulb gasket; interior aluminum glazing bead; glass description in paragraph 2.03; factory-glazed.

1.04 PERFORMANCE REQUIREMENTS

A. Conformance to AW-PG50-FW specifications in AAMA/NWWDA 101/I.S.2/A440-08 when tests are performed on a 60” x 99” minimum frame size with the following test results:

1. Air Infiltration: maximum 0.10 cfm/square foot when tested per ASTM E 283-04 at a static air pressure difference of 6.24 psf.
2. Water Penetration: no uncontrolled water leakage when tested per ASTM E 547-00 and ASTM E 331-00 at a static air pressure difference of 12 psf.
3. Uniform Structural: maximum 0.4% permanent deformation per member when tested per ASTM E 330-02 at a static air pressure difference of 105 psf.

B. Thermal testing per AAMA 507-15, at the prescribed 47" x 59" test size glazed with 1” insulating glass made with 1/8” clear lites, with the following test results:

1. Condensation Resistance Factor: minimum 73 system CRF.
2. Thermal Transmittance: maximum 0.38 BTU/HR/SQ.FT/F U value.

1.05 SUBMITTALS

A. Product Data: Manufacturer’s specifications, recommendations and standard details for window units.

B. Shop Drawings of the window system including window perimeter conditions and adjacent components coordinated with all involved trades. Drawings shall include the following:

1. Typical dimensioned elevations showing window openings.
2. Half-scale head, jamb, muntins, and sill sections, including all fastening components and trim.
3. Weep drainage capabilities.
4. Anchorage details.
5. Installation sequence showing relation to adjoining construction, in particular all flashing.
6. Drawings shall note and describe all materials and dimensional tolerance limits.
7. Revise drawings, if necessary, and resubmit shop drawings to Consultant for approval.

C. Shop drawing showing the results of the interior survey of the existing condition of interior finishes. Indicate on the drawings where interior finishes are damaged prior to starting the work.

D. Samples: Provide samples of all materials specified, each properly labeled with reference to specification paragraph numbers. Include:

1. Two samples of each required finish, on an extruded shape of aluminum.
2. A sample insulating glass unit, 12 in. x 12 in., with glass cut away and spacer exposed at one corner.
3. A "finished" sample insulating glass unit, 12 in. x 12 in., representative of the actual units to be provided for the project.

E. Proposed construction schedule showing the coordination of the expected start and completion dates for all aspects of the work, including preliminary scheduling and mobilization. Construction schedule shall include coordination with all involved trades. Make all reasonable changes to the schedule as required by the Owner at no additional cost.

F. Master plan schedule of work areas for approval by the Owner. Show the proposed access, staging, debris collection, and material storage locations for review by the Owner. Make all reasonable changes to the access, collection, and storage locations as required by the Owner at no additional cost.

G. Written certification (by the producers of the materials) that all materials supplied comply with all the requirements of the appropriate referenced standards, that all materials are compatible with adjacent materials, and that all materials are suitable for their intended purpose. If the proposed window will not meet performance requirements for some window configurations, promptly send the Consultant a written list of those windows and the reasons for non-compliance.

H. Reports documenting the laboratory testing as described the Testing Performance Requirements included in this Section.

I. Sealant compatibility reports including rubber glazing components to glass and glazing sealants in accordance with ASTM C1087. Include sealant compatibility between sealant, glazing components and window frame finish and preservatives. Reports shall address both chemical and adhesion compatibility issues.

J. Signed copies of the Guarantee form. Submission of the Guarantee form is a precondition to final payment.

1.06 QUALITY ASSURANCE

A. Contractor Qualifications: Not less than five (5) years successful experience with comparable projects and employing personnel skilled in glazing installation and related work.

B. Furnish a valid AAMA "Notice of Product Certification" indicating that the windows for the project conform to AAMA/NWWDA 101/I.S.2-97.

C. Field Samples: Prior to starting full-scale installation of the Work, prepare the following sample applications. Do not proceed with field samples until all materials have been submitted and approved.

1. A complete window installation including flashing, glazing, glazing sealants, perimeter sealants, etc.
2. Coordinate construction of field samples with Consultant and Owner. Schedule field sample installations to leave adequate time for cure of sealants, testing, and reconstruction, if needed, without delaying the project. Modify or construct a new field sample, at the written direction of the Consultant if the field sample does not meet the requirements. Rebuild the field sample as many times as required to meet the Consultant's approval.
3. Coordinate sealant adhesion tests with the work of Section 07 92 20 – Joint Sealants for Restoration.
4. Acceptable field samples, and method of procedure, will become the standard for Work of this Section.

D. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

E. Field testing shall be performed on mockups according to requirements in “Field Quality Control” Article.

F. Pre-Construction Conference: Convene one week prior to commencing work with the Owner and Consultant to discuss sequencing and installation procedures.

1.07 PRODUCT HANDLING

A. Coordinate locations for on-site staging with the Owner.

B. Package and neatly store materials in a manner that prevents surface damage or contamination, distortion, breakage or structural weakening. Replace any damaged materials.

1.08 WARRANTY

A. Reference Section 01 78 00 – Project Closeout and Warranties.

1.09 JOB CONDITIONS

A. Be prepared to immediately protect incomplete installations from damage by inclement weather.

B. Provide protection at open wall conditions due to delays in fabrication, shipment, and installation of the specified Work.

PART 2 – PRODUCTS

2.01 GENERAL

A. Listed are primary products and materials for window replacement work. Provide all incidental items and materials required for completion of the Work in accordance with these documents.

2.02 MATERIALS

A. Manufacturers:

1. EFCO Corporation, 1000 County Rd., Monett, Missouri, 65708, phone: (800) 221-4169.
2. Traco Windows, a division of Kawneer Co., Inc.; Technology Park / Atlanta; 555 Guthridge Court; Norcross, GA 30092.
3. Wausau Windows; 7800 International Drive; Wausau, WI 54401.

B. General Window Requirements – Basis of Design:

1. Wausau Window and Wall Systems – 4250 Series Fixed.
2. Single insulated glass unit per window.
3. Head and Sill Receptor

C. Aluminum Extrusions: Produced from commercial quality 6063-T5 alloy; free from defects impairing strength and durability.

1. Finish on Aluminum Extrusions:
   a. Finish:
      1) Exterior: Clear anodized
      2) Interior: Standard color selected by Owner; 70% 2-coat Kynar finish.
   b. Quality Standard: Conforming to AAMA 611-98.
   c. Thickness: AAM10C22A44 Class I - .7 mils.

D. Frame Thermal Break: Integral, structural glass-reinforced nylon, plastic or fiberglass composite thermal break “bars” or “webs”.

E. Fabrication: All members double tubular; corners mitered, double gusset reinforced, factory sealed with sealant conforming to AAMA 800, and crimped.

F. Size: Size frame to ensure glass perimeter is visible and not concealed behind interior finishes.

1. Frame depth 2-1/2” minimum.

2.03 INSULATING GLASS UNITS

A. Materials

1. Spacer: Composite material or stainless steel, with integrated dessicant.
   a. Metal Spacer Requirements: continuous with single weld.
   b. Composite Spacer: Technoform – Warm Edge.

2. Secondary Seal: Silicone.
3. Gas filling: Argon.

B. Performance

1. Dual-seal durability: Conformance to ASTM E 2190-02; visible, permanent IGCC certification label.
2. Thermal Transmittance: maximum 0.38 BTU/HR/SQ.FT/F U value.

C. Exterior Glass Lite: Provide glass thickness and type as required to meet performance requirements specified for actual window sizes.

1. Thickness: 1/8-inch, minimum.
2. Tint: Similar to existing. Owner to approve mock-up unit.
3. Type: Security Glass

D. Interior Glass Lite: Provide glass thickness and type as required to meet performance requirements specified for actual window sizes.

1. Thickness: 1/8-inch, minimum.
2. Tint: Clear.
3. Type: Fully tempered, minimum.
4. Coating: Hard coat Low E on #3 surface or as required to meet specified performance.

E. Manufacturing: All IGU seals shall be free of contaminants, including oils from hand contact (as identified by finger prints).

F. IGU Thickness: As required to meet performance requirements specified for actual window sizes.

2.04 ACCESSORY MATERIALS

A. Fasteners: Masonry fasteners, as required by the shop drawings.

B. Setting Blocks/Edge Blocking: Provide in sizes and locations recommended by GANA Glazing Manual. Setting blocks used in conjunction with soft-coat low-e glass shall be silicone.

C. All glazing components to be “silicone compatible.” Provide rubber manufacturer’s written confirmation of compatibility between rubber and silicones used in this glazing system, including the insulating glass edge seal.

D. Glazing Tape: Pre-shimmed butyl glazing tape conforming to AAMA 806-1.

E. Membrane Flashing: Perma-barrier by Grace Construction Products, with Liquid Membrane over all cuts and openings. Reference Section 07625 – Metal Flashing and Trim.

F. Metal Trim: Reference Section 07 62 50 – Metal Flashing and Trim.

G. Blocking / Nailers: Pressure-treated Southern Yellow Pine or Hem Fir; No. 2 grade; free from warping and visible decay.

H. Fasteners: Corrosion-resistant fasteners of length and diameter for positive engagement into the existing substrates.

I. Insulation: Un-faced thermal batt insulation for use in non-exposed application only.

1. Acceptable Products: CertainTeed Corp., Owens-Corning Fiberglass Corp., Mansville, or approved equal.

2.05 INTERIOR FINISHES

A. Provide accessory materials, such as joint compound, joint tape, etc. as required to make repairs to the existing interior finishes.

B. Provide interior primer matching the existing in color and finish.

PART 3 – EXECUTION

3.01 GENERAL

A. Conform to the latest edition of the glazing standards of the GANA (Glass Association of North America) "Glazing Manual" and "Sealant Manual."

B. Field-measure all window openings prior to removal of existing windows and new window fabrication. As a minimum, the Contractor shall verify that openings are dimensionally within allowable tolerances, plumb, level, contain solid anchoring surfaces and are in accordance with approved shop drawings. Variations in the size of openings should be expected. The Contractor is responsible for determining the variations. The window system must accommodate the full range of variations. Acceptable methods of accommodation include varied window frame sizes. The window system shall not protrude beyond the face of any portion of the exterior rough opening and shall be set firmly in the masonry / pre-cast concrete openings.

C. Provide temporary interior sheeting to contain dust and debris within the room where window replacement is taking place. Provide interior, portable air handling units with filters to clean the air.

D. Provide temporary interior protection at hallway / public areas in accordance with Section 02220 – Selective Demolition.

E. If the window is not replaced on the same day as it is removed, provide temporary weather-tight and secure cover over window opening, as shown on the approved shop drawing.

F. Coordinate selective demolition of existing construction in accordance with Section 02 42 00, and flashing work with Section 07 62 50, with all applicable trades prior to installation of new windows.

G. Remove all labels from the glass.

3.02 INSTALLATION OF WINDOW UNITS

A. General: Install windows per approved shop drawings, in proper relation to adjoining construction. Do not twist frames or force fit them into poorly prepared openings. Anchor windows as required to satisfy design requirements. See the manufacturer's installation instructions and shop drawings.

B. Center window units in wall openings leaving a uniform interface perimeter sealant recess on all four sides.

C. Level units: Plumb and align window faces in a single plane for each wall plane. Erect windows and materials square and true. Install shims at bearing locations, anchors, and latch point, so they are not dislodged by subsequent operations.

D. Anchorage: Anchor window units to substrate with specified anchors, as shown on the drawings. Size and spacing of anchors shall be as determined by structural calculations to maintain positions permanently when subjected to normal thermal and building movement and specified wind loads. All anchors shall be concealed.

3.03 INTERIOR REPAIRS

A. The Contractor shall survey all window areas to record all existing interior finish damage prior to starting the work.

B. Repair all damaged interior finishes caused by the work, matching the existing conditions.

C. Re-install the corresponding window treatment products.

3.04 FIELD QUALITY CONTROL

A. Contractor shall maintain or exceed levels of workmanship and material acceptability as established by field samples.

B. Contractor shall employ trained, skilled and experienced craftsmen for all phases of the Work.

C. Contractor shall make provision to assist and coordinate monitoring of the Work by the Manufacturer and Owner Representatives.

D. Testing Agency: Owner will engage a qualified testing agency for witnessing field testing, determining that the tests are performed correctly and making the final determination whether the curtain wall has successfully passed the tests.

E. The following tests will be performed in accordance with the methods and standards in the Performance Requirements article in Part Two of this section:
   1. Air Infiltration Tests – ASTM E 783, prior to installation of interior finishes.
   2. Water Penetration Tests - AAMA 501.1, prior to installation of interior finishes.
   3. Water Spray Test – AAMA 501.2, prior to installation of interior finishes.

E. Test Area: Three locations as determined by Owner/StructureTec; test areas to include/ typical window installation configurations and adjacent façade construction material conditions where applicable.

F. Window system will be considered defective if they do not pass tests and inspections.

G. Additional testing and inspections of failed window installations will be performed at Contractor's expense to determine compliance of replaced or additional work with specified requirements.

H. Institute protective measures required throughout the construction period to ensure that both interior and exterior of windows will be without damage or deterioration, other than normal weathering.

3.05 ADJUSTING AND CLEANING

A. Clean all window and glass surfaces (interior and exterior) at the time of Substantial Completion.

B. Contractor shall provide a written maintenance manual to the Owner which demonstrates proper cleaning methods and materials for glass.

C. Remove and dispose of all materials used to protect surrounding areas and building surfaces, following completion of the Work of this Section.

D. Repair, restore, or replace all materials, landscaping, interior finishes, and damaged surfaces to the satisfaction of the Owner at no additional expense.

END OF SECTION 08 52 00

SECTION 09 96 00

HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Work for this Section includes furnishing all labor, materials, equipment, and services to prepare and paint existing steel components.

B. Work for this Section includes the following:

1. Prepare and paint exposed steel wall system components.
2. Prepare and paint exposed structural steel components.

C. All new materials are to be interfaced with, and integrated into, existing materials to provide completed work that is sound and weathertight.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Paint Removal and Application:

1. Basis of Measurement: By the square foot, computed on the basis of rectangular solid shapes approximating the actual shape of paint removed and replaced.
2. Basis of Payment: Includes removals, surface preparation, and paint application.

1.03 REFERENCES

A. References are latest editions, unless otherwise indicated.

B. American Society for Testing and Materials (ASTM):

1. ASTM D 16: Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.

C. The Society for Protective Coatings (SSPC):

1. SSPC: Steel Structures Painting Manual.

D. Local, state or federal laws and regulations governing Volatile Organic Compounds (VOC) in paint or paint products.

E. Local, state, or federal laws and regulations governing paint removal.

1.04 SUBMITTALS

A. Product Data, certifications, and manufacturer's written preparation and application instructions for the specified materials.

1.05 QUALITY ASSURANCE

A. Contractor Qualifications: Not less than five (5) current years relevant successful experience with comparable projects and employing personnel skilled in the Work specified in this Section. The skilled person shall have at least five (5) years of experience and shall have successfully completed at least two (2) projects within the past three (3) years involving quantities and complexities similar to those required under this Section.

B. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five (5) years documented experience.

C. Source of Materials: Obtain materials from a single source for each type required, to ensure uniform quality, color, match, and texture.

D. Field Samples:

1. Five (5) lineal feet of existing steel cleaned and ready for coating applications.
2. Five (5) lineal feet of existing steel cleaned with coating applied.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer’s name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45°F and maximum of 90°F, in ventilated area, and as required by manufacturer’s instructions.

1.07 PROJECT CONDITIONS

A. Protect elements surrounding the Work from damage or disfiguration.

B. Provide adequate ventilation to remove material fumes as required to provide a safe area for work, and to confine and control fumes from migrating to adjacent areas.

C. All paint and thinner containers shall remain closed until required for use and shall be stored in areas with temperature ranges required by paint product manufacturer. All paint shall be mechanically mixed before use, in accordance with the manufacturer’s directions. Agitation during application must be provided where specified by the manufacturer.

D. The Contractor shall provide adequate supervision of the Work at all times. The Owner's Representative and Consultant shall have access to all work, in the shop or at the job site, to ensure that the surface preparation, application, and all aspects of the Work are being done according to the Specifications.

E. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL

A. Listed are the products and materials for the specified work. Provide all incidental items and materials required to complete the Work in accordance with these documents.

2.02 STEEL COMPONENTS

A. Coating

1. Urethane-based, zinc rich primer.
   a. Tneme-Zinc Series 135 by Tnemec Company Inc.

B. Top Coat (for exposed areas only)

1. Acrylic polyurethane top coat, as recommended by the primer manufacturer. Color to be selected by Owner.
   a. Endura-Shield Series 73 by Tnemec Company Inc. or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The Owner and Consultant have the right to determine and inspect surfaces and approve just prior to each coat. The Owner and Consultant shall require Contractor to touch up any scars, abrasions, or holidays in any coating before application of the next coat.

B. Inspection of work preparation, work in progress, and completed work shall be performed by the Consultant as follows:

1. Approval of dry film thickness per coat in accordance with Specification and manufacturer's written recommendations.
2. Approval of any deviations from the established Specification, when required by job schedule, if approved by Owner and Consultant.

C. Contractor shall inspect surfaces to which coating will be applied and report immediately in writing to the Consultant any conditions detrimental to the proper execution of this work. Absence of such notification will constitute the Contractor's acceptance of existing conditions.

D. The Contractor shall determine whether the air and surface temperature are suitable for application of paint. Paint and surface to which it is to be applied should be the same temperature.

3.02 PREPARATION

A. Clean all steel surfaces removing scaling and rust.

B. Prepare existing deteriorated steel surface to receive coating in accordance with paint manufacturer's recommendations and with The Society for Protective Coatings (SSPC) as follows:

1. SP-2, "Hand Tool Cleaning".
2. SP-3, "Power Tool Cleaning".
3. SP-6, "Commercial Blast Cleaning".

C. Inspect the condition of the exposed steel sections and connections (anchors and welds). Where the section loss of the steel member and/or connections is greater than 10 percent of the nominal thickness, report to the Consultant for review and corrective procedure (if any). Do not proceed with the coating work without written notification from the Consultant.

1. Primer: 3 mils (dry) / 5 mils (wet).
2. Top Coat: 2.5 mils (dry) / 4.5 mils (wet).

3.03 APPLICATION - STEEL COMPONENTS

A. When surfaces are prepared as noted above, apply coating as described in the manufacturer™™s written application instructions and as determined during the field sample applications.

B. Mix coating components following the manufacturer™™s written instructions.

C. Apply coating to a thickness of: 3 mils (dry)/5 mils (wet). Maintain coating thickness within the manufacturer™™s published maximum and minimum thickness ranges.

D. If additional coats are required to obtain the required coating thickness, apply additional coats after the initial coat is completely dried/cured.

3.04 FIELD QUALITY CONTROL

A. Contractor shall maintain or exceed levels of workmanship and material acceptability in regard to surface preparation and installation as established by the field samples.

B. Contractor shall employ trained, skilled and experienced craftsmen for all phases of the Work.

C. Contractor shall make provision to assist and coordinate monitoring of the Work by the Manufacturer and Owner Representatives.

3.05 ADJUSTING AND CLEANING

A. Clean site of all unused materials and waste in accordance with environmental regulations.

B. Remove and dispose of all materials used to protect surrounding areas and building surfaces, following completion of the Work of this Section.

C. Repair, restore, or replace all materials, landscaping, interior finishes, and surfaces damaged by the Work to the satisfaction of the Owner at no additional expense.

D. Collect waste material which may constitute fire hazard, place in closed metal containers and remove daily from site.

E. Remove all masking tape used to cover adjacent building components.

END OF SECTION 09 96 00

SECTION 09 96 50

ELASTOMERIC COATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all labor, materials, equipment and incidentals necessary to perform the required scope of work on the existing substrate as specified herein.

B. Work for this section includes the following:

1. Provide new elastomeric coating system to exterior surfaces, and concrete surfaces.

C. Application of coatings shall only be to surfaces that are structurally sound, and have been properly prepared in accordance with the manufacturer's requirements. All preparatory work shall include approval by the manufacturer's representative, , concrete repairs, installation of building sealants, and cleaning prior to application of coating system.

D. All new materials are to be interfaced with, and integrated into, existing materials in a manner that provides an aesthetically acceptable and completely weathertight system.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Coating Removal and Application:

1. Basis of Measurement: By the square foot, computed on the basis of rectangular solid shapes approximating the actual shape of coating removed and replaced.
2. Basis of Payment: Includes removals, surface preparation, coating application, and finishing.

1.03 REFERENCES

A. Steel Structures Painting Council (SSPC):

1. SSPC – SP2, Hand Tool Cleaning
2. SSPC – SP3, Power Tool Cleaning
3. SSPC – SP7, Brush-Off Blast Cleaning
4. SSPC – SP12, Surface Preparation By Water Jetting

B. Local, state or federal laws and regulations governing Volatile Organic Compounds (VOC) in paint or paint products.

C. Local, state, or federal laws and regulations governing paint removal.

1.04 PERFORMANCE REQUIREMENTS

A. Provide elastomeric coatings that comply with performance requirements specified in MPI 113.

B. Provide elastomeric coating systems with the following properties as determined by test methods indicated:

1. Elongation: Not less than 100 percent with a tensile strength of 200 psi and not less than 88 percent recovery after 1 hour and 90 percent recovery after 24 hours when tested according to ASTM D 2370 using parameters established by MPI 113.
2. Accelerated Weathering: No cracking, peeling, blistering, chalking, or visual deterioration after 1000 hours when tested according to procedures in ASTM G 155.
3. Low-Temperature Flexibility: No crack formation when tested according to ASTM D 1737.
4. Moisture-Vapor Transmission: Not less than 2.0 perms according to ASTM D 1653.
5. Wind-Driven Rain Resistance: No water penetration according to procedures in FS TT-C-555 at 95 mph.
6. Minimum Solids Content by Volume: Not less than 50.1 percent.
7. Volatile Organic Content (VOC): Not less than 55 g/L according to ASTM D 3960.

1.05 SUBMITTALS

A. Product Data:

1. Coating manufacturer's specifications, recommendations, and installation instructions.
2. Published data or certified test laboratory report that each material complies with requirements and is intended for application shown.
3. Written list of all materials proposed for use at this project.
4. Sample warranty and associated application report forms required by the manufacturer for warranty purposes.
5. Provide from coating manufacturer a written statement certifying the following:
   a. Status as an approved Contractor for product application for the manufacturer’s warranty.
   b. The manufacturer has verified that the specified work materials are a suitable application for their products. Include a listing of any specified or existing materials which may affect the performance of their products.

B. Conflicts between this specification and the coating manufacturer's requirements which would abrogate, or in any way nullify, the issuance of the required warranty is to be predetermined by the Contractor.

C. During Work:

1. The manufacturer's representative is to visit the project site during the initial full-scale setup and application of coating product, and provide instruction and recommendations to ensure optimal performance results.
2. Provide copies of manufacturer required job logs and test samples to the Owner's Representative and Consultant.

D. Samples: Submit two, 2' x 3' samples of each proposed finish, color, and texture to the Owner for approval.

1.06 QUALITY ASSURANCE

A. Contractor Qualifications: Not less than five (5) current years relevant successful experience with comparable projects and employing personnel skilled in the Work specified in this Section. The skilled person shall have at least five (5) years of experience and shall have successfully completed at least two (2) projects within the past three (3) years involving quantities and complexities similar to those required under this Section.

B. Manufacturer Qualifications: The manufacturer will be a company with at least ten (10) years documented experience and regularly engaged in the manufacturing and marketing of the products specified in the construction documents.

C. Source of Materials: Obtain materials from a single source for each type required, to ensure uniform quality, color, match, and texture.

D. Field Samples:

1. Field-Constructed Mock-ups
   a. Prior to starting work, and in conjunction with the Owner's Representative and Consultant, select a minimum of two (2) , separate wall areas which are representative of the total project for sample pre-cleaning, and application of coating product.
   b. Mock-up Size: Ten (10) feet x ten (10) feet (minimum).
   c. Manufacturer's Representative is to be notified and present during the preparation and application of the coating system to test sample areas.
   d. Cleaning methods and application of coating are to reflect the proposed procedures and workmanship expected during full-scale application.
   e. The location of approved test sample areas shall remain undisturbed during the work, and be retained as a standard for judging completed work. Do not alter or destroy the sample areas until all work is completed.

2. Field Adhesion Testing
   a. Notify the Consultant at least seven (7) days prior to coating application for field adhesion testing and at least seven (7) days prior to pull-testing so that a representative can be present during both operations. Failure to notify the Consultant constitutes failure of the samples tested.

b. At least eight weeks prior to the start of coating installation, apply specified coating to each job site substrate following specified procedures. Embed multiple pieces of cheese-cloth between coats. The cheese cloth shall be approximately 4 inches wide and 18 inches long, leaving a 6 inch loose tab. Prepare surface (including cleaning and priming) and install coating joints and strips as described below and as will be done during the general coating installation.
c. Pull-Testing: After curing for 21 days at prevailing outdoor temperatures, grasp the tabs on the ends of the cheese cloth and pull at 90º to the surface.
d. With acceptable applications, the coating shall fail cohesively (tearing within itself) with no adhesive (debonding) failure.
e. If any sample debonds from the substrate, the coating manufacturer shall make recommendations regarding changes in surface preparation or primers and submit these recommendations to the Consultant for approval. Repeat field adhesion tests using approved recommendations.
f. Repeat adhesion tests as many times as required to produce an acceptable application at no additional cost to the Owner. Acceptable application required prior to full scale coating installation.

E. Pre-Installation Conference: Convene prior to commencing work with the Owner and Consultant to discuss sequencing and installation procedures.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site intact and unopened in the manufacturer's original sealed containers with labels identifying manufacturer, product name, batch number, lot numbers, and shelf life when applicable. Material Safety Data Sheets and product data sheets with application instructions for each product shall accompany all shipments.

B. Store approved materials in accordance with manufacturer's instructions. As a minimum comply with the following:

1. Store all materials off the ground under watertight cover and away from sweating walls and other damp surfaces.
2. Immediately remove damaged or deteriorated materials from the job site.
3. Keep records of the quantities and batch numbers of materials stored.
4. Use necessary means to ensure safe storage and use of materials, as well as prompt and safe disposal of waste.
5. All coating and thinner containers shall remain closed until required for use and shall be stored in areas with a temperature between 50°F and 90°F.

C. Personnel shall be warned against prolonged breathing of vapors and contact of materials with skin or eyes. Keep products away from heat, sparks, and flame. Do not allow uses of spark producing equipment such as switches, appliances, etc. during application or until vapors are gone.

1.08 PROJECT CONDITIONS

A. Environmental Requirements:

1. Comply with manufacturer's requirements for environmental conditions under which systems can be applied.
2. Do not apply coating in areas where dust is being generated.
3. Do not apply coating in snow, rain, fog, or on damp/wet surfaces.
4. Coating application may be continued during inclement weather if areas and surfaces are enclosed and within temperature limits specified by the manufacturer during application and drying periods.

B. Close and seal all heating and ventilation ducts as required to prevent contamination and intake of fumes inside the building. Where ducts can not be closed, as determined by the Owner, provide filtering media for duct and fumes.

C. All coating shall be mechanically mixed before use, in accordance with the Manufacturer's directions. Agitation during application must be provided where specified by the manufacturer.

D. The coating shall be done by skilled painters and/or qualified apprentices directed by same. The manufacturer's instructions regarding application shall be followed. Criteria of good workmanship desired shall be proper surface preparation in accordance with these Specifications, a neat appearance of the finished surfaces and the absence of ridges, sags, runs, drops, laps, and unnecessary brush marks. Other criteria are thorough mixing of coating, limited use of thinners, uniformity of film thickness, removal of dust, grease, and other foreign matter, conservation of coating materials, proper drying time between coats, and protection of surfaces not to be coated.

E. The Contractor shall provide adequate supervision of the work at all times. The Owner or his representative shall have access to all work, in the shop or at the job site, to ensure that the surface preparation, application, and all aspects of the work are being done according to the Specifications.

F. Care must be taken to prevent intercoat contamination, particularly from industrial fallout, over spray of coating, greasy hands, oil mists, and the like. If contamination does occur, proper cleaning must be used, and finish coated as soon as the surface is dry.

G. Protect finished surfaces from rain, dirt, dust, and work of other trades for not less than 48 hours.

H. Provide "Wet Paint" signs to protect newly coated finishes.

1.09 WARRANTY

A. Reference Section 01780 - Project Closeout and Warranties.

PART 2 - PRODUCTS

2.01 GENERAL

A. Listed are the products and materials for the specified work. Provide all incidental items and materials required to complete the Work in accordance with these documents.

B. A single manufacturer's products are referred to for identification. Products of other listed manufacturers meeting the requirements itemized below may be submitted for approval. The Contractor shall bear the full cost of review of alternate systems by the Consultant, including fees, expenses, travel to review previous products, etc., regardless of outcome or determination. Unless approved by the Consultant, obtain waterproofing system materials from the same manufacturer. Check all specified items upon contract signing and order early so that the work is not delayed. Certain materials may require considerable lead time for delivery.

C. Coatings shall be measured in terms of mil thickness (0.001"). Total dry mil thickness shall not be less than called for. If the total dry film coating thickness required is not obtained by use of the number of coats shown, additional coats shall be applied until the specified total is provided. Recoating will take place within the time limits specified by the coating supplier.

D. All coats shall be applied in such a manner as to produce a film of uniform smoothness. Special attention shall be paid to crevices, rivet lines, bolt heads, corners, edges, etc., to obtain the required thickness.

2.02 MATERIALS

A. Acrylic Elastomeric Coating

1. Type: Single component, high-build, elastomeric, 100% acrylic coating with high elongation, high vapor permeability, and hairline crack bridging characteristics.
2. Acceptable Products
   a. "BASF / MasterProtect HB 400.
   b. or approved equal
   c.
3. Dry Film Thickness: Provide in accordance with the manufacturer's instructions and as required for warranty. As a minimum, elastomeric coating is to be applied in two coats to attain not less than 16 to 18 mils dry thickness.
4. Color: To match existing surfaces, or as selected and approved by Owner. Base coat shall be one shade lighter than finish coat. Finish coat will have a texture as approved by Owner contain a medium sand finish unless otherwise directed by Owner.
5. Primer: Provide product required for existing surfaces and as recommended by coating manufacturer.

B. Cleaners:

1. Materials used for cleaning shall be approved by the coating manufacturer to ensure compatibility.
2. Pre-mixed, commercially available cleaner, specially prepared for use with spray equipment and cleaning exterior surfaces and concrete surfaces.

2.03 ACCESSORIES

A. Tarps or polyethylene sheeting for protection of existing landscaping and building surfaces.

B. Masking tape: Pressure sensitive adhesive paper tape.

C. Shop Cloths: Use shop cloths or clean lint-free rags for cleaning operations.

D. Sealant for Coating System: Provide as recommended or required by coating manufacturer.

2.04 MIXING AND THINNING

A. Mix the coating materials according to the manufacturer's recommendations, to a homogenous consistency. Thoroughly disperse any coating solids that may have settled to the bottom of the container.

B. Do not thin coating materials.

C. Ensure uniform color of coating materials between batches.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The Contractor shall be responsible for inspecting the substrate and verifying that no conditions are present which may prevent or otherwise interfere with installation of the proposed elastomeric coating or with obtaining the required manufacturer's warranty.

B. Inspect surfaces for the following:

1. Contamination including: algae, dirt, dust, efflorescence, form oil, fungus, grease, laitance, mildew or other foreign substances.
2. Surface absorption and chalkiness.
3. Cracks: Measure crack width and record location of cracks.
4. Damage and deterioration.
5. Moisture content and moisture damage: Use a moisture meter to determine if the surface is dry enough to receive the coatings and record any areas of moisture damage.

C. Report in writing any adverse conditions which might affect the performance of the coating to the Consultant within three (3) calendar days. Absence of such notification shall constitute the Contractor's verification that existing conditions will allow installation of the system in accordance with the plans and specifications, as well as the manufacturer's requirements and recommendations.

D. Before ordering materials or performing work, obtain and verify all measurements at the project site. Exact measurements are the Contractor's responsibility.

3.02 PREPARATION

A. General:

1. Repair, patch, and fill all cracks, voids, defects, and damaged areas in existing surfaces. Allow repair materials to cure completely before application of coating product.
2. Perform sealant work specified in Section 07920 – Joint Sealants prior to coating application. Do not coat joint sealants unless compatibility is demonstrated by adhesion testing and approved by the Consultant. Provide masking as required to prevent application of coating onto joint sealants and all non-coated surfaces.
?. Remove old coating, caulking, sealers, roofing tar, dust, dirt, oils, grease, laitance, efflorescence, mildew, fungus, and any other materials that may inhibit adhesion of the coating product. Clean exterior surfaces by using a low-pressure water/ detergent cleaning procedure. Clean masonry surfaces by using a high-pressure (3000 psi) waterblasting, sandblasting, or mechanical wire brushing**.**
3. Remove or protect signs, outlets, lighting fixtures, windows, doors, landscaping, roofs, vehicles, and other adjacent surfaces at the Project. Cleaning or replacement of existing surfaces due to inadequate protection is the Contractor's responsibility.
4. Coordinate temporary shutdown and protection at air intake ducts/vents with the Owners Representative to prevent objectionable fumes from entering the interior.

B. Cracks:

1. Static cracks up to 1/16" generally can be bridged by elastomeric coating with a heavy-brush application. Verify with the coating manufacturer.
2. Static cracks over 1/16" wide and all dynamic cracks/joints require proper repair and joint sealant application, in accordance with the appropriate substrate Section in this specification.

3.03 APPLICATION

A. Verify that existing surfaces have been repaired, cleaned, and are dry before proceeding.

B. Labels: Do not coat over any code-required labels or equipment name, identification, performance rating or nomenclature plates.

C. Apply coating products by roller, brush, or spray equipment, as recommended by the manufacturer for the specific project substrates and conditions, following the manufacturer's written specifications and as determined by the test samples.

D. Maintain minimum (and maximum) thickness of each coat. Apply additional coats as required to obtain the minimum total system thickness.

E. Allow primer / coating to dry / cure for a minimum of 12 hours, or as recommended by the manufacture (if longer). Allow additional time as required to account for current ambient temperature, surface temperature, and relative humidity at the time of application.

F. Apply the coating to the entire area in a continuous application, always working to a wet edge to eliminate cold joints.

G. Back Rolling: Backroll all final coat applications (regardless of application method). Backrolling shall be performing in the same direction for the entire project to prevent differences in appearance.

H. All finished coating applications must match approved samples for color, texture, coverage, and be free of pinholes to ensure waterproofing performance.

3.04 FIELD QUALITY CONTROL

A. Contractor shall maintain or exceed levels of workmanship and material acceptability in regard to surface preparation, cleaning, and coating application as established by mock-up/test samples.

B. Contractor shall employ trained, skilled and experienced craftsmen for all phases of the work.

C. Contractor shall make provision to assist and coordinate inspections of the work by the Manufacturer and Owner Representatives, and perform adhesion testing, dry film thickness measurements, etc., as required.

D. During project sealant application, test adhesion of exterior perimeter sealant joints at 30%, 60%, and 90% sealant completion. Three weeks after installation, cut a tab on a joint and test adhesion similar to that described above. Patch test areas in accordance with manufacturer's instructions. If application is not acceptable to the Consultant, conduct additional test as directed by the Consultant.

E. Wet mil. thickness measurements shall be taken by the Contractor during application process and submitted to the Consultant. Additionally, the Consultant will perform thickness measurements during field reviews to verify system requirements; the Contractor shall repair coating at measurement locations.

3.05 ADJUSTING AND CLEANING

A. Clean site of all unused materials, residues, and waste in accordance with environmental regulations.

B. Clean tools and equipment with water immediately after use. Dried material can only be removed mechanically.

C. Remove and dispose of all materials used to protect surrounding areas and building surfaces, following completion of the work of this section.

D. Repair, restore, or replace all materials, landscaping, and surfaces damaged by coating product to the satisfaction of the Owner at no additional expense.

END OF SECTION 09 96 50

SECTION 15 16 00

ROOF DRAINS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Replace all existing plastic drain components with cast iron components as specified.
2. Furnish new clamping rings, domes, and bolts for all existing drains, as required.

1.02 REFERENCES

A. Workmanship, apparatus, equipment, materials, and testing shall conform to the requirements of the latest specifications of:

1. American Society of Mechanical Engineers (ASME)
2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)
4. Building Officials Code Administration (BOCA)
5. International Conference of Building Officials (ICBO Uniform Codes)

1.03 SYSTEM DESCRIPTION

A. Install piping so as to occupy a minimum of space. Install parallel and close to walls, ceiling, columns or other members providing proper space for covering or removal of pipes.

1.04 SUBMITTALS

A. Submit Shop Drawings and Catalog Sheets in accordance with the requirements of this Specification, and as herein specified before ordering materials or equipment for the following:

1. Roof drains
2. Cleanouts
3. Plumbing line layout
4. Plumbing line supports
5. Pipes

B. Substitutions

1. Products are referenced in this specification to establish a standard of quality, style, design and function of materials, equipment, apparatus or product.
2. Submit substitutions in accordance with the General Conditions of this Specification.
3. This Contractor assumes all engineering and construction cost necessary for revision in the Work of other trades due to the substitute material or equipment.

1.05 PROJECT/SITE CONDITIONS

A. Contractor is responsible for dimensions in the field and verifying ceiling heights or other architectural and structural details before installing any piping.

B. Notify the Owner and Consultant in writing of any difference which may be found before proceeding with the Work.

1.06 QUALITY ASSURANCE

A. Test the storm drain system under normal conditions of use per the requirements of the authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 NEW ROOF DRAINS

A. Josam 21500 series coated cast iron roof drain, cast iron dome, wejloc non-puncturing clamp ring, large sump with wide roof flange, four inch bottom no-hub outlet complete with deck clamp and drain receiver by Josam Manufacturing Co., Michigan City, IN.

B. Smith 1010 16 inch diameter duco cast iron body, combined flashing clamp, cast iron dome, four inch bottom outlet no-hub outlet, complete with under deck clamp and sump receiver by Smith, Jay R. Manufacturing Co., Inc., Montgomery, AL.

C. Wade 3000 16 inch diameter painted cast iron body, combined flashing ring, cast iron dome, four inch bottom no-hub outlet, complete with deck clamp and bearing pan by Tyler Pipe, Tyler, TX.

D. Zurn Z-100 15 main roof drain, Dura-Coated cast iron body with combined membrane flashing clamp and cast iron dome, four inch outlet, no-hub outlet, complete with under deck clamp and sump receiver by Zurn Industries, Inc., Hydromechanics Division, Erie, PA.

2.02 PIPES AND FITTINGS

A. Pipe: CISPI Standard 301, hub less cast iron pipe, four-inch diameter minimum. Applicable Plumbing Codes, depending upon horizontal slope and whether pipe services more than one drain, may require larger diameter pipe.

B. Fittings: CISPI Standard 301, complete with approved elastomeric sealing sleeves and stainless steel (300 series) clamps, clamping screws, expansion joints; and all hangers, anchors, etc., for proper installation of entire system.

2.03 ACCESSORIES

A. Supports and Hangers: Stainless steel, 12 inches long, 180 degree arc, 3/4 inch bearing surface.

B. Insulation: Preformed Owens-Corning Fiberglas #25 ASJ, one inch thick, to fit piping. Provide mitered sections of same material with jointing tape to cover fittings. Provide integral vapor barrier with Zeston fittings as manufactured by Owens Corning, or approved equal. At the Contractor's option, insulation may be a complete system of closed cell polyurethane installed per the manufacturer's recommendation. Smoke and flame spread shall conform to code.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Coordination

1. Install all new drains, receivers, clamps, and miscellaneous supports at locations determined by the Owner's field representative. Connect drains immediately to new piping.
2. When installing new drains, carefully coordinate the cutting of the deck, insulation, and membrane roofing with the Owner's field representative.
3. Any plastic and/or pvc components, excluding drain body, shall be replaced with new cast-iron components.

B. Preparation

1. All bituminous residues shall be removed from inside of existing drain bowls at the clamping ring seat.
2. Remove flashing collar and clean. If broken, provide new collar.
3. All broken or damaged drain components shall be replaced.

3.02 INSTALLATION - DRAINS

A. Install the roof drain clamping ring and all clamping bolts. Tighten the clamping bolts to achieve constant compression. Install drain strainer/domes.

3.03 INSTALLATION – PIPING & INSULATION

A. Install all piping parallel to building walls and column lines at such height for proper drainage and as to not interfere with doorways, stairway, or traffic. Connect to existing main; verify invert elevations, pipe size and capacity.

B. Keep suspended pipes as close to the ceiling as possible and at a uniform grade. Maintain height above existing ceiling panel, or as approved by the Owner.

C. Make all exposed piping neat in appearance.

D. Work pipe into place without springing.

E. Install all piping such that it will drain and vent as shown and/or as required. Pitch all horizontal lines 1/8 inch per foot minimum.

F. Any new openings in existing walls or deck necessary for the installation of the new piping or drains shall be neatly cut and of the minimum possible size for the proper installation of the new work.

G. All plumbing must be completely connected into acceptable and approved drainage systems, existing or new as per the scope of work. All work must be in conformance with applicable building code. All work must be authorized and inspected by local building authority.

H. Install accessible cleanouts per code.

I. Insulate drain piping in conformance to local building code.

3.04 INSTALLATION – HANGER & SUPPORT

A. Support piping in the building on stainless steel hangers of clevis type with adjustable stainless steel rods.

B. Properly support all piping installed on suitable pipe hangers and supports. All equipment or permanent hangers, supports, and anchors shall be fabricated from durable materials suitable for the service conditions and in accordance with the details on the Drawings.

C. Base required strength of all supporting equipment on the combined weight of the piping filled with water.

D. Provide hangers required for piping material in occupied areas equal to Grinnell No. 104, adjustable stainless steel ring hangers attached to stainless steel rods secured to ceiling construction with epoxy set anchors in an approved manner, five feet on center maximum spacing.

3.05 FIELD QUALITY CONTROL

A. The building is to remain absolutely watertight during installation of new drains. The deck and membrane is not to be cut if any ponded water exists on roof surface.

B. Contractor shall not damage any interior or exterior finishes, including floors, ceilings, and walls.

C. Restore all surfaces damaged by the operations of this section to "like new" condition, at no additional cost to the Owner.

D. Verification:

1. Upon completion of the installation of each drain and attached piping, visually inspect and verify that all components are complete and properly installed.
2. Verify that all new drains and piping are securely attached to the building structure, are in working order, and are absolutely watertight.

3.06 CLEANING

A. At completion of all plumbing work, remove all construction debris and equipment from job site. Contractor is to ensure that all building components (ceilings, lights, etc.) are undamaged and properly in place.

END OF SECTION 15 16 00

DETAILED SPECIFICATIONS

INTERIOR RENOVATIONS

SECTION 02 41 00

INTERIOR DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of interior elements for alteration purposes.

1.02 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.03 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of three years of documented experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Remove portions of existing buildings including, but not limited to, the following:
   1. Interior gypsum board partitions, wallcovering.
   2. Doors, frames and hardware.
   3. Resilient flooring, resilient base, carpet, quarry tile, ceramic tile.
   4. Suspended acoustical ceilings, gypsum board ceilings.
   5. Casework.

B. Remove concrete slabs on grade as indicated on drawings.

C. Remove other items indicated, for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.

4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
5. Do not close or obstruct roadways or sidewalks without permit.
6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

B. Do not begin removal until receipt of notification to proceed from Owner.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
1. Verify that construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
2. Provide, erect, and maintain temporary fire-resistive partitions of construction specified in Section 01 50 00 in locations indicated on drawings.

C. Remove existing work as indicated and as required to accomplish new work.
1. Remove items indicated on drawings.

D. Flooring: Where shown, scheduled or otherwise required for application or installation of new floor finishes or coverings, remove existing carpet, flooring tile, resilient sheet flooring as follows:
1. Remove all traces of existing flooring materials. Remove resilient sheet and tile flooring products in compliance with recommended methods of Resilient Floor Covering Institute "Recommended Work Practices for Removal of Resilient Floor Coverings."
2. Remove adhesives, except those containing asbestos. Use chemical strippers approved by manufacturer of new flooring materials, or grind concrete floor surfaces to completely remove adhesive. Obtain Owner's Representative's approval of removal method prior to beginning removal work.
3. Clean floor slabs of dust and adhesive residue.

E. Cutting Concrete Floors: Before core drilling, saw-cutting, or breaking up concrete floors, test for the presence of electrical conduits. Use an impulse induction type scanner, similar to Hilti Ferroscan, capable of detecting both metallic conduits and copper wires in PVC conduits. Tracers that scan for energized cables or that scan for injected high frequency signals are not acceptable. Immediately restore, at no cost to the Owner, conduits damaged during cutting operations. Comply with the following notification requirements:
1. Notify the Owner's Representative not less than 72 hours in advance of each core drilling/saw-cutting operation. Owner's Representative will arrange notification of building occupants of potential for power outage.

2. Notify the Owner's Representative prior to conducting each test.

F. Core drilling and saw-cutting shall be conducted by wet methods only, to reduce dust production.

G. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
3. Verify that abandoned services serve only abandoned facilities before removal.
4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

H. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch as specified for patching new work.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE - INTERIOR

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Patching slabs on grade.

B. Concrete reinforcement.

C. Joint devices associated with concrete work.

D. Concrete curing.

1.02 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

B. ACI 301 - Specifications for Structural Concrete; 2016.

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; 2004 (Errata 2007).

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.

E. ACI 305R - Guide to Hot Weather Concreting; 2010.

F. ACI 306R - Cold Weather Concreting; 2010.

G. ACI 308R - Guide to Curing Concrete; 2001 (Reapproved 2008).

H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2016).

I. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

J. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

K. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016.

L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2016b.

M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2016a.

N. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.

O. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

P. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2016.

Q. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

R. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2016.

S. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.

T. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.

U. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2015.

V. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014a.

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
   1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.

C. Mix Design: Submit proposed concrete mix design.

D. Mix Design: Submit for approval prior to pour.

E. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.04 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.01 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.

2.02 CONCRETE MATERIALS

A. Cement: ASTM C 150, Type I - Normal Portland type.
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.

C. Fly Ash: ASTM C618, Class C or F.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.03 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

E. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.

F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

G. Accelerating Admixture: ASTM C494/C494M Type C.

H. Retarding Admixture: ASTM C494/C494M Type B.

I. Water Reducing Admixture: ASTM C494/C494M Type A.

2.04 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: If encountered during slab on grade demolition, replace damaged areas with like material and seal joints.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Grout: Comply with ASTM C1107/C1107M.
   2. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   3. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

2.05 BONDING AND JOINTING PRODUCTS

A. Epoxy Bonding System:
   1. Complying with ASTM C881/C881M and of Type required for specific application.

2.06 CURING MATERIALS

A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.

B. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
   1. Application: Use where concrete slab patching occurs within area of previously sealed concrete.
   2. Verify compatability with adjacent existing sealer to ensure overlap
   3. Vehicle: Water-based.
   4. Solids by Mass: 25 percent, minimum.
   5. VOC Content: OTC compliant.
   6. Manufacturers:
      a. BASF Construction Chemicals-Building Systems; Product Kure-N-Seal 25 ES: www.buildingsystems.basf.com.
      b. Dayton Superior Corporation; Product Cure & Seal 1315 EF: www.daytonsuperior.com.
      c. Euclid Chemical; Product Everclear VOX: www.euclidchemical.com.
      d. L&M Construction Chemicals, Inc.; Product Dress & Seal WB: www.lmcc.com.
      e. Substitutions: Not permitted.

C. Moisture-Retaining Sheet: ASTM C171.
   1. Curing paper, regular.
   2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
   3. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.

D. Water: Potable, not detrimental to concrete.

2.07 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

C. Normal Weight Concrete:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch.
   2. Water-Cement Ratio: Maximum 40 percent by weight.
   3. Maximum Slump: 3 inches.
   4. Maximum Aggregate Size: 3/4 inch.

2.08 MIXING

A. Depending on quantity required, provide either:

1. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
2. Transit Mixers: Comply with ASTM C94/C94M.
    a. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

B. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
    1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

C. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

D. Interior Slabs on Grade: If encountered during slab demolition, install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Notify Architect not less than 24 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Ensure reinforcement will not be disturbed during concrete placement.

F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

A. Locate joints to match/continue existing joints, if any.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints, to match, if any: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

A. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
   2. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.08 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Surfaces Not in Contact with Forms:
   1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the

approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.

2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by saturated burlap.
3. Final Curing: Begin after initial curing but before surface is dry.
   a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.
   b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.09 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

3.10 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 REFERENCE STANDARDS

A. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

B. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Bolts, Nuts, Washers and Threaded Rods: ASTM A307, Grade A, plain.

B. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Folding Panel Track Suspension Members: threaded rods channel sections; prime paint finish.

2.04 FINISHES - STEEL

A. Prime paint steel items.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Prime Painting: One coat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY - INTERIOR

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire retardant treated wood materials.

B. Concealed wood blocking, nailers, and supports.

C. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2016.

D. PS 20 - American Softwood Lumber Standard; 2015.

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Provide technical data on fire resistive treatments.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Spruce-Pine-Fir (South), unless otherwise indicated.
   2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.

3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
1. Species: Spruce-Pine-Fir (South).
2. Lumber: S4S, No. 2 or Standard Grade.
3. Boards: Standard or No. 3.

2.03 ACCESSORIES

A. Fasteners and Anchors:
1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.04 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

B. Fire Retardant Treatment:
1. Manufacturers:
a. Dricon: www.dricon.com
b. Hoover Treated Wood Products, Inc: www.frtw.com/#sle.
c. Koppers, Inc: www.koppersperformancechemicals.com/#sle.
d. Substitutions: Not permitted.
2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

b. Do not use treated wood in applications exposed to weather or where the wood may become wet.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. Provide the following specific non-structural framing and blocking:
1. Cabinets and shelf supports.
2. Wall brackets.
3. Grab bars.
4. Towel and bath accessories.
5. Wall-mounted door stops.
6. Marker boards.

3.03 CLEANING

A. Waste Disposal:
1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 41 00

ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Open shelving.

D. Cabinet hardware.

1.02 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.

C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

E. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, fastening methods, jointing details, finishes, and accessories.
   1. Provide the information required by AWI/AWMAC/WI (AWS).

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet finishes indicating each variation of material, color, pattern, grain/cut, and sheen.

E. Samples: Submit actual sample items of proposed finishes.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Wood Veneer Faced Cabinet:
   1. Semi-Exposed Surfaces: HPVA HP-1 Grade B, Natural Ash, plain sliced, random-matched.
   2. Concealed Surfaces: Manufacturer's option.

C. Cabinets:
   1. Finish - Exposed Exterior Surfaces: Wood.
   2. Finish - Exposed Interior Surfaces: Wood.
   3. Finish - Semi-Exposed Surfaces: Wood
   4. Finish - Concealed Surfaces: Manufacturer's option.
   5. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
   6. Casework Construction Type: Type A - Frameless.
   7. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
   8. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
      a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
   9. Cabinet Design Series: As indicated on drawings.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Urea-Formaldehyde Prohibition:
   1. Overall Project Requirement: Provide composite wood and agrifiber products having no added urea-formaldehyde resins.

2.03 LUMBER MATERIALS

A. Hardwood Lumber: HPVA HP-1 Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade II/Custom; average moisture content of 5-10 percent; species as recommended by manufacturer.

B. Softwood Lumber: NIST PS 20; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade II/Custom; average moisture content of 5-10 percent; species as recommended by manufacturer.

2.04 PANEL MATERIALS

A. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, composed of wood chips bonded with interior grade adhesive under heat and pressure; sanded faces; thickness as required; use for components indicated on drawings.

2.05 LAMINATE MATERIALS

A. Manufacturers:
   1. Match color, texture and pattern indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.
   2. Substitutions: Not permitted.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
   1. Provide specific types as indicated.
   2. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, colors as indicated, finish as indicated.
   3. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as indicated, finish as indicated.
   4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.06 SOLID SURFACING

A. Manufacturers:
   1. Match color, texture and pattern indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.
   2. Substitutions: Not permitted.

B. Solid Surfacing: Solid surfacing sheet or plastic resin casting .
   1. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISSFA-2 and NEMA LD 3; acrylic or polyester resin, unfilled, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E 84.

2.07 COUNTERTOPS

A. Match material, color, texture and pattern indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.

B. Plastic Laminate Countertops: Particleboard substrate, 3/4 inch thick each layer, covered with HPDL, conventionally fabricated and self-edge banded.

C. Solid Surfacing: Particleboard subtrate, 3/4 inch thick each layer, covered with solid surfacing, 1/2 inch thick, self-edge banded.

2.08 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application and approved by manufacturer of materials being adhered as being non-detrimental.

1. Adhesives and Joint Sealants:

a. Definition: This provision applies to gunnable, trowelable, and liquid-applied adhesives, sealants, and sealant primers used anywhere on the interior of the building inside the weather barrier, including duct sealers.

b. Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

Architectural Applications	VOC Limit [g/L less water]	Specialty Applications	VOC Limit [g/L less water]
Indoor Carpet Adhesives	50	PVC Welding	510
Carpet Pad Adhesives	50	CPVC Welding	490
Wood Flooring Adhesives	100	ABS Welding	325
Rubber Flooring Adhesives	60	Plastic Cement Welding	250
Subfloor Adhesives	50	Adhes. Primer for Plastic	550
Ceramic Tile Adhesives	65	Contact Adhesive	80
VCT Flooring Adhesives	50	Special Purpose Contact	250
Drywall & Panel Adhesives	50	Structural Wood Member	140
Cove Base Adhesives	50	Sheet Applied Rubber Lining Operations	850
Multipurpose Construction	70	Top & Trim Adhesive	250
Structural Glazing Adhes.	100		
Substrate Specific Applications	VOC Limit [g/L less water]	Sealants	VOC Limit [g/L less water]
Metal to Metal	30	Architectural	250
Plastic Foams	50	Nonmembrane Roof	300
Porous Material (except wood)	50	Roadway	250
Wood	30	Single-ply Membrane Roof	450
Glass Fiber (e.g.Fiberglass)	80	Other	420
		Sealant Primers	VOC Limit [g/L less water]

		Architectural Non-Porous	250
		Architectural Porous	775
		Other	750

1) Require each installer to certify compliance and submit product data showing product content.

c. Specific Product Categories: Comply with limitations specified elsewhere.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

2.09 HARDWARE

A. Hardware: BHMA A156.9, types as scheduled for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
1. Product: 255 & 256 manufactured by Knape & Vogt.

C. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome finish, for nominal 1 inch spacing adjustments.
1. Product: 87 & 187 manufactured by Knape & Vogt.
2. Spacing of Standards: 32 inch on-center maximum, unless specifically indicated otherwise.

D. Drawer and Door Pulls: "U" shaped wire pull, aluminum with satin finish, 4 inch centers.

E. Catches: Touch type.

F. Hinges: European style concealed self-closing type, steel with polished finish.
1. Manufacturers:
a. Grass America Inc: www.grassusa.com.
b. Blum, Inc: www.blum.com.
c. Substitutions: Not permitted.

2.10 SHOP TREATMENT OF WOOD MATERIALS

A. Provide UL (DIR) listed and approved identification on fire retardant treated material.

B. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

2.11 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. All scribed fillers shall match adjacent cabinetry material.
   1. Fillers shall close off the fronts and toe kicks of base wall cabinets including horizontally above the toe kick.
   2. Fillers shall close off the tops, fronts, and bottoms of upper wall cabinets.

E. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet from sink cut-outs.
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

F. Provide cutouts for plumbing fixtures, inserts, outlet boxes, fixtures and fittings, and grommets. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.12 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

C. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 5, Varnish, Conversion.
      b. Stain: As selected by Architect.
      c. Sheen: Satin, unless indicated otherwise

D. Prime paint surfaces in contact with cementitious materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units and countertops.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinets and counter bases to floor using appropriate angles and anchorages.

G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not.

1.02 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2016a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.

C. ITS (DIR) - Directory of Listed Products; current edition.

D. FM 4991 - Approval Standard for Firestop Contractors; 2013.

E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

F. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Sustainable Design Submittal: Submit VOC content documentation for all non-preformed materials.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and:

1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
2. Verification of minimum three years documented experience installing work of this type.
3. Verification of at least five satisfactorily completed projects of comparable size and type.
4. Licensed by local authorities having jurisdiction (AHJ).
5. Approved by firestopping manufacturer.

1.05 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers:
1. A/D Fire Protection Systems Inc.: www.adfire.com.
2. 3M Fire Protection Products: www.3m.com/firestop.
3. W.R. Grace: www.na.graceconstruction.com.
4. Hilti, Inc: www.us.hilti.com/#sle.
5. Johns Manville: www.johns-manville.com
6. Nelson FireStop Products: www.nelsonfirestop.com.
7. NUCO: www.sealantcentre.com.
8. RectorSeal Corp.: www.rectorseal.com.
9. Specified Technologies, Inc.: www.stifirestop.com.
10. Substitutions: Not permitted.

B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.02 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
1. Fire Ratings: Use any system listed by UL, FM, or ITS (Warnock Hersey) or tested in accordance with ASTM E814 or ASTM E119 that has F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and that meets all other specified requirements.
2. Fire Ratings: See drawings for required ratings.

2.03 MATERIALS

A. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Color: red prefered, dark grey acceptable.

B. Foam Firestoppping: Single component silicone foam compound; conforming to the following:
   1. Durability and Longevity: Permanent.

C. Fibered Compound Firestopping: Formulated compound mixed with incombustible non-asbestos fibers; conforming to the following:
   1. Durability and Longevity: Permanent.

D. Fiber Firestopping: Mineral fiber insulation used in conjunction with elastomeric surface sealer forming airtight bond to opening; conforming to the following:
   1. Durability and Longevity: Permanent.

E. Firestop Devices - Wrap Type: Mechanical device with incombustible filler and sheet stainless steel jacket, intended to be installed after penetrating item has been installed; conforming to the following:
   1. Durability and Longevity: Permanent .

F. Intumescent Putty: Compound that expands on exposure to surface heat gain; conforming to the following:
   1. Potential Expansion: Minimum 1000 percent.
   2. Durability and Longevity: Permanent.

G. Reusable Firestopping: Removable intumescent compressible shapes, pillows, or blocks specifically tested in removable configuration; conforming to the following:
   1. Durability and Longevity: Permanent.

H. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS - INTERIOR

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.

B. ASTM C834 - Standard Specification for Latex Sealants; 2014.

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

F. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Samples for Selection: Where sealant color is not specified, submit two samples of actual beads, buttons, or ribbons illustrating sealant colors for selection.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience and approved by manufacturer.

C. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. Other joints indicated below.
   2. Do not seal the following types of joints.
      a. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
      b. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      c. Joints where installation of sealant is specified in another section.
      d. Joints between suspended panel ceilings/grid and walls.

2.02 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.03 NONSAG JOINT SEALANTS

A. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, neutral curing, mildew and fungus resistant, non-staining, non-bleeding; not expected to withstand continuous water immersion or traffic.
   1. Color: Clear.
   2. Service Temperature Range: Minus 65 to 180 degrees F.
   3. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   4. Applications: Use for:
      a. Seal around plumbing fixtures, countertops, side and back splashes, casework, ceramic tile, and other joints subject to moisture.
   5. Manufacturers:
      a. Bostik Inc; Chem-Calk 1200: www.bostik-us.com.

b. Dow Corning Corporation; 786 Mildew Resistant: www.dowcorning.com.
c. Sherwin-Williams Company; Silicone Rubber All Purpose Sealant: www.sherwin-williams.com.
d. Substitutions: Not permitted.

B. General Purpose Interior Sealant: Acrylic Emulsion Latex: Water-based; ASTM C834, Type OP, single component, non-staining, non-bleeding, non-sagging, paintable; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Grade: ASTM C834; Grade - NF.
3. Applications: Use for:
a. Interior wall and ceiling control joints.
b. Joints between door and window frames and wall surfaces.
c. Other interior joints for which no other type of sealant is indicated.
4. Manufacturers:
a. BASF Construction Chemicals-Building Systems; Sonolac: www.buildingsystems.basf.com.
b. Bostik Inc; Chem-Calk 600: www.bostik-us.com.
c. Sherwin-Williams Company; White Lightning 3006 Siliconized Acrylic Latex Caulk: www.sherwin-williams.com/#sle.
d. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com/#sle.
e. Tremco Global Sealants; Tremflex 834: www.tremcosealants.com.
f. Substitutions: Not permitted.

C. Acoustical Sealant for Concealed Locations:
1. Applications: Use for concealed locations only:
a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
2. Products:
a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant: www.pecora.com.
b. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
c. USG; Sheetrock Acoustical Sealant: www.usg.com.
d. Substitutions: Not permitted.

2.04 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 CLEANING

A. Clean adjacent surfaces soiled by sealant installation.

3.05 PROTECTION

A. Protect sealants until cured.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOOR FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal frames for wood doors.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; 2010; (ADA Standards for Accessible Design).

B. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

C. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.

F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2015.

G. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

H. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

I. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

J. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

K. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

L. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.

M. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
4. Steelcraft, an Allegion brand: www.allegion.com/#sle.
5. Substitutions: Not permitted.

2.02 DESIGN CRITERIA

A. Requirements for Hollow Metal Door Frames:
1. Steel used for fabrication of doors frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
2. Accessibility: Comply with Michigan Building Code, ANSI/ICC A117.1 and the ADA Accessibility Guidelines.
3. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated

must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
   2. Frame Finish: Factory primed and field finished.

C. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

D. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

2.04 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.05 ACCESSORIES

A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

B. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Spot grout frame anchors in gypsum board construction.

D. Install door hardware as specified in Section 08 71 00.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; non-rated.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; 2010; (ADA Standards for Accessible Design).

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

C. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

D. ICC A117.1 - Accessible and Usable Buildings and Facilities; International Code Council; 2009 (ANSI).

E. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.

F. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Manufacturer's Installation Instructions: Indicate special installation instructions.

D. Warranty, executed in Owner's name.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

C. Accessibility: Comply with Michigan Building Code, ANSI/ICC A117.1 and the ADA Accessibility Guidelines.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.06 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.07 WARRANTY

A. Interior Doors: Provide manufacturer's warranty for the life of the installation.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
1. Eggers Industries: www.eggersindustries.com/#sle.
2. Graham Wood Doors: www.grahamdoors.com/#sle.
3. Marshfield DoorSystems, Inc: www.marshfielddoors.com/#sle.
4. Mohawk Flush Doors, Inc.: www.mohawkdoors.com.
5. V-T Industries: www.vtindustries.com
6. Substitutions: Not permitted.

2.02 DOORS

A. Doors: Refer to drawings for locations and additional requirements.
1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
1. Provide solid core doors at each location.
2. Smoke and Draft Control Doors in Corridors and Smoke Barriers: In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft of door opening at 0.10 inch wg pressure at both ambient and elevated temperatures for "S" label; if necessary, provide additional gasketing or edge sealing.

3. Wood veneer facing for field transparent finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White Oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
   1. See Door Schedule on drawings.
   2. Vertical Edges: Same species as face veneer.
   3. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

B. Veneer Facing for Transparent Finish: Natural Ash, vertical grain, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
   1. See Door Schedule on drawings.
   2. Vertical Edges: Same species as face veneer.
   3. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

C. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

C. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

D. Provide edge clearances in accordance with the quality standard specified.

2.06 ACCESSORIES

A. Hollow Metal Door Frames: As specified in Section 08 11 13.

B. Door Hardware: As specified in Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install smoke and draft control doors in accordance with NFPA 105 requirements.

B. Field-Finished Doors: Trimming to fit is acceptable.

C. Adjust width of non-rated doors by cutting equally on both jamb edges.
   1. Trim maximum of 3/4 inch off bottom edges.

D. Use machine tools to cut or drill for hardware.

E. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

C. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches surface area.

D. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE **- SEE DRAWINGS**

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood doors.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. BHMA A156.14 - American National Standard for Sliding and Folding Door Hardware; 2013.

C. BHMA A156.28 - American National Standard for Recommended Practices for Mechanical Keying Systems; 2013.

D. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

E. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.

F. DHI (H&S) - Sequence and Format for the Hardware Schedule; 1996.

G. DHI (KSN) - Keying Systems and Nomenclature; 1989.

H. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

I. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.

J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

K. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.

L. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

M. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

C. Keying Requirements Meeting:
   1. Owner will schedule meeting at project site prior to Contractor occupancy.
   2. Attendance Required:
      a. Contractor.
      b. Owner.
      c. Installer's Architectural Hardware Consultant (AHC).
      d. Hardware Installer.
   3. Agenda:
      a. Establish keying requirements.
      b. Establish keying submittal schedule and update requirements.
   4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
   5. Record minutes and distribute copies within two days after meeting to participants, with one copies to Architect, Owner, participants, and those affected by decisions made.
   6. Deliver established keying requirements to manufacturers.

1.04 SUBMITTALS

A. See Section 01330 - 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.
   1. Submit concurrent with Hardware Schedule, for each item listed in Schedule.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Conform to DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
      a. Submit in vertical format.
   3. List groups and suffixes in proper sequence.
   4. Provide complete description for each door listed including single or pair, door number, hand, active leaf, degree of swing, door size and material, frame material, and fire-resistance rating.
   5. Provide 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. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
   1. Submit manufacturer's parts lists and templates.

F. Keying Schedule:
   1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

G. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

H. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

I. Inspection Report: Submit inspection report as specified under Field Quality Control with copies to the Architect, Owner, Contractor, hardware distributer and hardware installer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.
   1. Shall be an established firm dealing in contract builders hardware, a factory authorized dealer for all materials required, with adequate inventory, and be located within 100 miles of the Project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.07 WARRANTY

A. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
   1. Closers: Ten years, minimum.
   2. Exit Devices: Three years, minimum.
   3. Locksets and Cylinders: Three years, minimum.
   4. Other Hardware: One year, minimum.

B. During the warranty period, replace defective work, including labor, materials and other costs incidental to the work. Inspect the work within 24 hours after reciept of notice from the Owner.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

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. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. 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.
   4. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   5. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.

D. 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. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.

2.02 MANUFACTURERS - BASIS OF DESIGN

A. As specified in the sections below.

B. Substitutions: Not permitted, unless specifically indicated.

2.03 HINGES

A. Manufacturers:
   1. McKinney; an Assa Abloy Group company: www.assaabloydss.com.
   2. Bommer Industries, Inc: www.bommer.com.
   3. Hager Companies: www.hagerco.com.
   4. Stanley Security Solutions: www.stanleysecuritysolutions.com.

2.04 TRACK AND HANGERS

A. Sliding and Bifolding Door Hardware: Complying with BHMA A156.14.
   1. Provide track, hanger fasteners, guides, and pulls; size track and hangers in accordance with manufacturer's recommendations for weight of doors.
   2. Provide one pull for each pair of panels hinged together.

2.05 FLUSH BOLTS

A. Manufacturers:
   1. McKinney, an Assa Abloy Group company: www.assaabloydss.com.
   2. Hager Companies: www.hagerco.com.
   3. Ives, an Allegion brand: www.allegion.com/us.

2.06 EXIT DEVICES

A. Manufacturers:
   1. Von Duprin, an Allegion brand: www.allegion.com/us.

B. Exit Devices:
   1. Lever design to match lockset trim.
   2. Provide cylinder with cylinder dogging or locking trim.
   3. Provide exit devices properly sized for door width and height.
   4. Provide strike as recommended by manufacturer for application indicated.
   5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.07 LOCK CYLINDERS

A. Manufacturers:
   1. Best, dormakaba Group: www.bestaccess.com/#sle.
   2. Medeco: www.medeco.com.
   3. Schlage, an Allegion brand: www.allegion.com/us.

B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
   1. Provide cams and/or tailpieces as required for locking devices.

2.08 MORTISE LOCKS

A. Manufacturers:
   1. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company: www.assaabloydss.com.
   2. Best, dormakaba Group: www.bestaccess.com/#sle.
   3. Schlage, an Allegion brand: www.allegion.com/us.

B. Mortise Locks:

1. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
   a. Finish: To match lock or latch.

2.09 DOOR PULLS AND PUSH PLATES

A. Manufacturers:
   1. Hager Companies: www.hagerco.com.
   2. Hiawatha, Inc, division of Activar Construction Products Group, Inc: www.activarcpg.com/hiawatha.
   3. Ives: www.iveshardware.com.
   4. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.

2.10 COORDINATORS

A. Manufacturers:
   1. Provide from same manufacturer as flushbolts.

B. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
   1. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.11 CLOSERS

A. Manufacturers; Surface Mounted:
   1. LCN, an Allegion brand: www.allegion.com/us.

2.12 OVERHEAD STOPS AND HOLDERS

A. Manufacturers:
   1. Rixson or Sargent; an Assa Abloy Group company: www.assaabloydss.com.
   2. Glynn-Johnson, an Allegion brand: www.allegion.com/us.

2.13 KICK PLATES

A. Manufacturers:
   1. Hager Companies: www.hagerco.com.
   2. Hiawatha, Inc, an Activar Construction Products Group company: www.activarcpg.com/hiawatha.
   3. Ives, an Allegion brand: www.allegion.com/us.
   4. Equal products of any BHMA member.

B. Edges: Beveled, on four sides unless otherwise indicated.

2.14 WALL STOPS

A. Manufacturers:

1. Ives, an Allegion brand: www.allegion.com/us.
2. Equal products of any BHMA member.

2.15 KEY CONTROL SYSTEMS

A. Key Control Systems: Complying with guidelines of BHMA A156.28.
   1. Provide keying information in compliance with DHI (KSN) standards.
   2. Door Locks: Master keyed as coordinated with the Owner.
      a. Provide and install removable cylinders for construction keying.
      b. Final cylinders will be provided by Contractor and installed during project turn over.
   3. Keying: Master keyed.
   4. Include construction keying and control keying with removable core cylinders.
   5. Key to existing keying system.
   6. Deliver keys with identifying tags to Owner by security shipment direct from hardware supplier.

2.16 FINISHES

A. Finishes: Identified in Door Hardware Schedule.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware for smoke and draft control doors in accordance with NFPA 105.

C. Use templates provided by hardware item manufacturer.

D. Do not install surface mounted items until application of finishes to substrate are fully completed.

E. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
   2. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
   3. Mounting heights in compliance with ADA Standards.
   4. Round concave/convex wall stops shall be mounted to impact latchset/lockset handles.
   5. Projecting type wall stops shall be mounted to impact the head of the door, not the foot of the door near the wall base.

3.02 FIELD QUALITY CONTROL

A. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

B. Submit a written report certifying compliance or recording loactions and kinds of non-compliance. A final certification shall be provided after non-complying items have been corrected.

C. Instruct Owner's personnel in adjustment, care and maintenance of hardware.

3.03 ADJUSTING

A. Adjust hardware for smooth operation after the permanent HVAC system is in operation.

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.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.05 PROTECTION

A. Do not permit adjacent work to damage hardware or finish.

HARDWARE SET SCHEDULE - ATTACHED

END OF SECTION

Door Hardware Sets:

Hardware Group No. 01

For use on mark/door #(s):
011

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	WALL STOP	WS406/407CCV	626	IVE

Hardware Group No. 02

For use on mark/door #(s):
014

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	606	SCH
1	EA	WALL STOP	WS406/407CCV	626	IVE

Hardware Group No. 03

For use on mark/door #(s):
012H

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	TRACK	200FD		JOH
3	EA	HINGE	5BB1 4.5 X 4	652	IVE
1	EA	FINGER PULL	DP3/AS	626	MOC

Hardware Group No. 04

For use on mark/door #(s):
012C 012D 012E 012F 012G

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	TRACK	200FD		JOH
6	EA	HINGE	5BB1 4.5 X 4	652	IVE
2	EA	FINGER PULL	DP3/AS	626	MOC

SECTION 09 06 01

INTERIOR FINISH KEY AND SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Products.

B. Product options.

PART 2 PRODUCTS

2.01 MANUFACTURERS/PRODUCTS

A. Scheduled on the drawings.

2.02 PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

B. Refer to individual Sections for additional manufacturers, products and requirements.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: products of one of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

D. Substitutions may be considered when a product becomes unavailable through no fault of Contractor. Failure of the Contractor to consider delivery lead time schedules when ordering products shall not be acceptable grounds for considering substitutions.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Metal channel ceiling framing.

C. Acoustic insulation.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.02 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.

B. AISI SG-971 - Specification for the Design of Cold-Formed Steel Structural Members; 1996, with 2000 Supplement.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

I. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

J. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

K. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

L. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

M. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.

N. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

O. GA-216 - Application and Finishing of Gypsum Board; 2013.

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.04 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840.

B. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum three years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com/#sle.
   2. Jaimes Industries: www.jaimesind.com/#sle.
   3. Marino: www.marinoware.com/#sle.
   4. Substitutions: Not permitted.

B. Metal Framing Connectors and Accessories:
   1. Same manufacturer as framing.

C. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.

D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems of fire rating and movement required.
   4. Deflection and Firestop Track:
      a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. Continental Building Products (formerly Lafarge NA): www.continental-bp.com.
   2. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
   3. National Gypsum Company: www.nationalgypsum.com/#sle.
   4. USG Corporation: www.usg.com/#sle.
   5. Substitutions: Not permitted.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   3. Thickness:
      a. Vertical Surfaces: 5/8 inch.

C. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces behind thinset tile, except in wet areas.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Type: Regular, in locations indicated.
   4. Regular Board Thickness: 5/8 inch.
   5. Edges: Tapered.

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: As indicated on drawings.

B. Acoustic Sealant: As specified in Section 07 92 00.

C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

1. Types: As detailed or required for finished appearance.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   3. Ready-mixed vinyl-based joint compound.
   4. Chemical hardening type compound.

E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

G. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members at 16 inches on center.

C. Studs: Space studs as scheduled.
   1. Extend partition framing to just above ceiling unless scheduled otherwise.
   2. Partitions Terminating just above Ceiling: Extend every third stud to structure above for bracing.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install blocking for support of plumbing fixtures, wall cabinets, toilet accessories, and hardware. Comply with Section 06 10 00 for wood blocking.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based or chemical hardening type joint compound and finished with ready-mixed vinyl-based or sandable chemical hardening type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Non-ceramic trim.

1.02 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2017.
   1. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).

B. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.

C. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2016.

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 12 by 12 inches in size illustrating pattern, color variations, and grout joint size variations.

D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.05 FIELD CONDITIONS

A. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

A. Match size, thickness, color, texture, edge condition and pattern indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.
   1. Substitutions: Not permitted.

B. Ceramic Mosaic Tile: ANSI A137.1, standard grade.

C. Glazed Wall Tile: ANSI A137.1, standard grade.
   1. Trim Units: Matching surface bullnose and cove shapes in sizes coordinated with field tile.

D. Quarry Tile: ANSI A137.1, standard grade.

2.02 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall tile.
      b. Wall corners, outside.
   2. Manufacturers:
      a. Schluter-Systems; Product Rondec: www.schluter.com/#sle.
      b. Substitutions: Not permitted.

B. Thresholds: Solid Surfacing Material, specified in Section 06 41 00.
   1. Height and bevels to comply with ADA and MBC requirements.
   2. Applications:
      a. At doorways where tile terminates.

2.03 SETTING MATERIALS

A. Manufacturers:
   1. ARDEX Engineered Cements: www.ardexamericas.com.
   2. Bostik Inc: www.bostik-us.com.
   3. Custom Building Products: www.custombuildingproducts.com.
   4. LATICRETE International, Inc: www.laticrete.com/sle.
   5. Mapei: www.mapei.us.
   6. ProSpec, an Oldcastle brand: www.prospec.com
   7. TEC, an H.B. Fuller Construction Products Brand: www.tecspecialty.com/#sle.
   8. Substitutions: Not permitted.

2.04 GROUTS

A. Match size and color indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.

B. Manufacturers:
   1. ARDEX Engineered Cements: www.ardexamericas.com.
   2. Bostik Inc: www.bostik-us.com/#sle.
   3. Custom Building Products: www.custombuildingproducts.com.
   4. LATICRETE International, Inc: www.laticrete.com/#sle.
   5. Mapei: www.mapei.us.
   6. ProSpec, an Oldcastle brand: www.prospec.com.
   7. TEC, an H.B. Fuller Construction Products Brand: www.tecspecialty.com/#sle.
   8. Substitutions: Not permitted.

C. Polymer (Latex) Modified Grout: ANSI A118.7 polymer modified cement grout.
   1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Color(s): As indicated.

D. Tile Sealant: Refer to Section 07 92 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION - GENERAL

A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1 through ANSI A108.13, manufacturer's instructions, and TCA Handbook recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated.

K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with The Tile Council of North America Handbook Method F113, dry-set or latex-Portland cement bond coat, with polymer modified grout, unless otherwise indicated.

3.05 INSTALLATION - WALL TILE

A. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2016.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

E. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.

F. UL (GGG) - GREENGUARD Gold Certified Products; current listings at http://http://productguide.ulenvironment.com/QuickSearch.aspx.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two full size samples illustrating material and finish of acoustical units.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Match size, thickness, color, texture, edge condition and pattern indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.
   1. Substitutions: Not permitted.

B. Acoustical Units - General: ASTM E1264, Class A.
   1. VOC Content: Certified as Low Emission by one of the following:
      a. Product listing in UL (GGG).
      b. Product listing in CHPS (HPPD).

2.02 SUSPENSION SYSTEM(S)

A. Match size, color, profile and edge condition indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.
   1. Substitutions: Not permitted.

B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

C. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; intermediate-duty.
   1. Profile: Tee; 15/16 inch wide face.
   2. Finish: As indicated on drawings.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size, unless otherwise noted.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Miter corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Resilient stair accessories.

D. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Verification Samples: Submit two samples, illustrating color and pattern for each resilient flooring product specified.

D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Do not double stack pallets.

1.06 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Match size, thickness, color, texture and pattern indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.
   1. Substitutions: Not permitted.

2.02 STAIR COVERING

A. Match size, thickness, color, texture and pattern indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.
   1. Substitutions: Not permitted.

B. Stair Treads with Integral Risers: Rubber; full height of riser, full width and depth of tread in one piece; tapered thickness.

2.03 RESILIENT BASE

A. Match size, thickness, color, texture and pattern indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.
   1. Substitutions: Not permitted.

B. Resilient Base: ASTM F1861, Type scheduled; top set Style B, Cove.
   1. Length: Roll.

2.04 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
   1. Compatible with materials being adhered; maximum VOC content of 50 g/L.

C. Moldings, Transition and Edge Strips: Interior.
   1. Match size, thickness, color, texture, and pattern indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.
      a. Substitutions: Not permitted.

D. Installer shall select from the following transition profiles for best fit of materials and thicknesses:
   1. Johnsonite listed as representative product models: www.johnsonite.com.
   2. Other Acceptable Manufactures:
      a. BurkeMercer Flooring Products: www.burkemercer.com.
      b. Roppe Corp: www.roppe.com.
   3. Reducer between resilient flooring and carpet
      a. Johnsonite, Model CTA-XX-(A or C) Series
   4. Reducer between quarry tile and walk-off matts
      a. Johnsonite, Model CTA-XX-(K or similar) Series
   5. Reducer between carpet and walk-off matts
      a. Johnsonite, Model CTA-XX-(H or similar) Series

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints and butt seams tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Resilient Strips: Attach to substrate using adhesive.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Adhere over entire surface. Fit accurately and securely.

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 68 13

TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016.

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2015.

C. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

D. CRI (GLP) - Green Label Plus Testing Program - Certified Products; www.carpet-rug.org; current edition.

E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Match size, thickness, weight, color, texture, pattern and backing indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 Interior Finish Key and Schedule.

B. Substitutions: Not permitted.

C. Tile Carpeting: As scheduled, manufactured in one color dye lot.
   1. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
   2. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
   3. VOC Content: Provide CRI (GLP) certified product.

2.02 ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Moldings and Edge Strips: As indicated in Section 09 06 01 Interior Finish Key and Interior Finish Schedule, material and color as selected.

C. Adhesives:
   1. Compatible with materials being adhered; maximum VOC content of 50 g/L.
   2. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 91 23

INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, and varnishes.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2015.

D. SSPC-SP 1 - Solvent Cleaning; 2015.

E. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

F. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.04 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Systems Schedule: Provide systems schedule based on specified Paint Systems, listing products to be provided for each coat of each system. Coordinate with product data submittal.
   1. If systems other than those of the specified Base Manufacturer are proposed, submit a schedule that lists the Acceptable Manufacturer's systems in identical format to the Paint Systems scheduled herein.

C. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

D. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

E. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

F. Manufacturer's Instructions: Indicate special surface preparation procedures.

G. Maintenance Data: Submit data including material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, and repair of painted and finished surfaces.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

1.06 MOCK-UP

A. Provide panel of at least 100 square feet illustrating coating color, texture, and sheen.

B. Provide door and frame assembly illustrating stain and varnish color, texture, and finish.

C. Locate where directed by Architect or Owner.

D. Approved mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Provide paints and finishes from the same manufacturer to the greatest extent possible.

C. Paints:
1. Base Manufacturer: Benjamin Moore & Co: www.benjaminmoore.com.
2. PPG Paints: www.ppgpaints.com/#sle.
3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

D. Primer Sealers: Same manufacturer as top coats.

E. Substitutions: Not permitted.

2.02 PAINTS AND FINISHES - GENERAL

A. Match product, color, and sheen indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.

B. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each paint material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

C. Primers: As required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

D. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
   a. Paints and Coatings:
      1) Architectural paints, coatings and primers site-applied to interior walls and ceilings:
         a) Provide only products not exceeding volatile organic compound (VOC) content limits as established by Green Seal GS-11.
            1 Flats: 50 g.L.
            2 Non-Flats: 150 g/L.
      2) Anti-corrosive and anti-rust paints site-applied to interior ferrous metal substrates:
         a) Provide only products not exceeding VOC content limit of 250 g/l as established by Green Seal GC-03.
      3) Clear wood finishes, floor coatings, stains, sealers and shellacs site-applied to interior elements:
         a) Provide only products not exceeding VOC content limits as established by the South Coast Air Quality Management District Rule 1113.

Material	VOC Limit	Material	VOC Limit
Clear Wood Varnish	350	Waterproofing Sealers	250
Clear Wood Lacquer	550	Sanding Sealers	275
Floor Coatings	100	All Other Sealers	200
Clear Shellac	730	Stains	250
Pigmented Shellac	550		

      4) Require each installer to certify compliance and submit product data showing product content.
   b. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

E. Chemical Content: The following compounds are prohibited:

1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

F. Flammability: Comply with applicable code for surface burning characteristics.

G. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

2.03 PAINT SYSTEMS - INTERIOR

A. Specific products listed below are generally Benjamin Moore unless noted otherwise. Refer also to acceptable manufacturers listed above.

B. Wood, Transparent, Conversion Varnish, Stain:
1. Filler coat (for open grained wood only).
2. Washcoat (for closed grain wood only); conversion varnish reduced.
3. One coat of stain; Lemma Quick Stain Alkyd 1AS.12xx.
4. One coat sealer.
5. Gloss: Two coats of varnish; Megavarplus Gloss 1M.6309.
6. Satin: Two coats of varnish; Megavarplus 1M6306/1A.622.

C. Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer; #P04.
2. Semi-gloss: Two coats of latex enamel; Super Spec HP #29.

D. Ferrous Metals, Primed, Latex, 2 Coat:
1. Touch-up with latex primer; #P04.
2. Semi-gloss: Two coats of latex enamel; Super Spec HP #29.

E. Galvanized Metals, Latex, 3 Coat:
1. One coat galvanize primer; #P04.
2. Semi-gloss: Two coats of latex enamel; Super Spec HP #29.

F. Gypsum Board/Plaster, Latex, 3 Coat:
1. One coat of latex primer sealer; Ultra Spec N534.
2. Eggshell: Two coats of latex enamel; Ultra Spec N538.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

H. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

I. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning

according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

J. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

3.06 SCHEDULE - PAINT SYSTEMS AND COLORS

A. Provide paint system, colors, and sheens as indicated in Section 09 06 01 - Interior Finish Key and Schedule.

END OF SECTION

SECTION 10 11 01

VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass Markerboards.

1.02 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Provide manufacturer's data on markerboard and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

D. Samples: Submit color charts for selection of color of markerboard.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Visual Display Boards:
   1. Clarus: www.clarus.com
   2. Substitutions: Not permitted.

2.02 VISUAL DISPLAY BOARDS

A. Markerboards: Tempered safety glass, 1/4 inch thick, eased edges, anti-ghosting; back painted; with magnetic-capable backer.
   1. Color: White.
   2. Size: As indicated on drawings.
   3. Frame: No frame.
   4. Accessories: Provide marker tray; concealed mounting hardware and anchors.

2.03 ACCESSORIES

A. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of chalkboard, molded ends, concealed fasteners, satin finish.

B. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Secure units level and plumb.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10 22 39

FOLDING PANEL PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Salvage and rework guide track and supports.

B. Salvage and resurface folding panels.

C. Existing top-supported folding panel partition, horizontal opening, manual operation.

1.02 REFERENCE STANDARDS

A. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions; 2012.

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Samples for Review: Submit two samples of surface finish, 12 by 12 inches size, illustrating quality, colors selected, texture, and weight.

C. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

PART 2 PRODUCTS

2.01 FOLDING PANEL PARTITIONS - HORIZONTAL OPENING

A. Folding Panel Partitions - Existing: Side opening; continuous hinged panels; side stacking; manually operated.

B. Panel Construction: Existing; reconfigure location as indicated on drawings.

C. Panel Finishes:
   1. Match weight, color, texture and pattern indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Room Finish Schedule.
   2. Strip and re-upholster existing folding panels.

D. Suspension System: Reconfigure existing as indicated on the drawings.

E. Performance:
   1. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

2.02 MATERIALS

A. Adhesives:
   1. Compatible with materials being adhered; maximum VOC content of 50 g/L.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.

3.02 INSTALLATION

A. Install partition in accordance with manufacturer's instructions and ASTM E557.

B. Lubricate moving components.

3.03 ADJUSTING

A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

C. Adjust partition assembly to achieve lightproof seal.

3.04 CLEANING

A. Clean finish surfaces and partition accessories.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of partition and identify potential operational problems.

END OF SECTION

SECTION 10 26 00

WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.03 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
   1. Submit two samples of corner guard finishes, 3 by 5 inches square.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Store products in either horizontal or vertical position, in conformance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner Guards:
   1. Construction Specialties, Inc: www.c-sgroup.com/#sle.
   2. Inpro: www.inprocorp.com/#sle.
   3. Nystrom, Inc: www.nystrom.com/#sle.
   4. Substitutions: Not permitted.

2.02 PRODUCT TYPES

A. Match color, texture and pattern indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.

B. Corner Guards - Surface Mounted:
   1. Material: Polyethylene terephthalate (PET or PETG); PVC-free with full height extruded aluminum retainer.
   2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   3. Width of Wings: 2 inches.
   4. Corner: Square.
   5. Color: As indicated.
   6. Length: One piece.
   7. Preformed end caps.

C. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

2.03 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard 4 inches above finished floor (top of resilient base) to ceiling, soffit or bulkhead.

3.03 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.

C. ASTM C1036 - Standard Specification for Flat Glass; 2016.

D. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.04 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products listed by model numbers are made by Bobrick, unless noted otherwise.

B. Other Acceptable Manufacturers:
   1. ASI - American Specialties, Inc: www.americanspecialties.com.
   2. Bradley Corporation: www.bradleycorp.com.
   3. Substitutions: Not permitted.

C. Provide products of each category type by single manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

C. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, stainless steel, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
   1. Bobrick 2888.

B. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
   1. Capacity: 300 C-fold minimum.
   2. Bobbrick 262.

C. Combination Towel Dispenser/Waste Receptacle: Surface mount with projecting waste receptacle, stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors.
   1. Waste receptacle liner: Reusable, heavy-duty vinyl.
   2. Towel dispenser capacity: 600 C-fold or 800 multifold.
   3. Waste receptacle capacity: 15 gallons.
   4. Products:
      a. Bobrick B-43949.
      b. Substitutions: Not permitted.

D. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock.
   1. Bobrick 2111.

E. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
   2. Size: Indicated on drawings.
   3. Frame: 0.05 inchangle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.

4. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
5. Bobrick 290.

F. Grab Bars: Stainless steel, smooth non-slip surface.
1. Standard Duty Grab Bars:
a. Push/Pull Point Load: 250 pound-force, minimum.
b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
c. Finish: Satin.
d. Length and Configuration: As scheduled.
e. Bobrick 6806.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated on drawings.

END OF SECTION

SECTION 11 06 01

EQUIPMENT COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contractor responsibilities regarding equipment to be furnished by the Owner for installation and final connection by Contractor.

1.02 DRAWINGS

A. Refer to Floor Plans included within the Drawing set, for locations of major equipment items being furnished by the Owner or being salvaged by the Contractor during demolition, for installation and final connection by Contractor. The Contractor shall coordinate and install concealed wall blocking required for support of Owner supplied and Contractor installed equipment. The Contractor shall coordinate, provide and make final connections to mechanical and electrical services for equipment furnished by the Owner, as indicated on Drawings.

1.03 COORDINATION

A. Verify and coordinate all measurements where Owner equipment is affected. Refer to equipment installation drawings for additional coordination information on wall reinforcement, structural support, mechanical services and electrical services required for proper equipment installation and operation.

B. The Contractor shall cooperate and work in conjunction with the Owners forces where Owner supplied and/or installed equipment is noted.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Where the Contractor is responsible for the installation and/or final connection of Owner supplied equipment, the Contractor shall provide all miscellaneous fittings, fasteners, devices, support and accessories as required for a complete equipment installation.

B. The successful bidding Contractor will be provided with an Equipment Plan Spreadsheet printout, including manufacturer’s catalogue cuts sheets and Equipment Data Sheets, for Owner supplied and/or installed equipment, for Contractor reference in coordinating related services and components. Obtain, coordinate and confirm with Owner final equipment data sheets for listed equipment well in advance of beginning rough-in work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings, supports, services and components required for operation of Owner supplied and/or installed equipment are in place in accordance with equipment manufacturer's printed instructions.

B. Verify that rough-in conditions and services for equipment are correctly sized and located.

3.02 INSTALLATION

A. Where equipment installation and/or final connection of Owner supplied equipment is the responsibility of the Contractor, the Contractor shall install equipment in strict accordance with equipment manufacturer's printed instructions.

END OF SECTION

SECTION 12 48 13

ENTRANCE FLOOR MATS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet mat.

1.02 SUBMITTALS

A. See Section 01330 - Submittal Procedures.

B. Product Data: Provide data indicating properties of walk-off surface, component dimensions.

C. Samples: Submit two full size samples illustrating pattern and color.

D. Maintenance Data: Include cleaning instructions, and stain removal procedures.

PART 2 PRODUCTS

2.01 MATS

A. Match material, color, texture and pattern indicated by reference to manufacturer's standard designations for these characteristics in Section 09 06 01 - Interior Finish Key and Schedule.

B. Carpet Mat:
1. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
2. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
3. VOC Content: Provide CRI (GLP) certified product.

2.02 ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Moldings and Edge Strips: As indicated in Section 09 06 01 Interior Finish Key and Interior Finish Schedule, material and color as selected.

C. Adhesives:
1. Compatible with materials being adhered; maximum VOC content of 50 g/L.
2. Carpet Mat Adhesive: Recommended by carpet mat manufacturer; releasable type.

PART 3 EXECUTION

3.01 PREPARATION

A. Vacuum clean floor substrate.

3.02 INSTALLATION

A. Install walk-off surface after cleaning of finish flooring.

END OF SECTION

INDEX OF PLUMBING SPECIFICATIONS
FOR
ANN ARBOR WATER DEPARTMENT INTERIOR RENOVATION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

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:
1. Plumbing demolition.

1.3 SUBMITTALS

A. Product Data: For the following:
1. Mechanical sleeve seals.

B. Welding certificates.

1.4 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."

C. 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.

1.5 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.

1.6 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. 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. 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.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASTM A-354 Grade BD and SAE J-429 Grade 8 for steam and condensate application, and ASTM A-354 and SAE J-429 Grade 5 for other low service temperature applications, 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, 95/5 tin-copper. 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. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
2. CPVC Piping: ASTM F 493.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

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. Manufacturers:

    a. Central Plastics Company.

b. Watts Industries, Inc.; Water Products Div.
c. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Central Plastics Company.
b. Watts Industries, Inc.; Water Products Div.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Lochinvar Corp.

F. 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. Manufacturers:

a. Perfection Corp.; Clearflow Dielectric Waterway.
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. Manufacturers:

a. Link-Seal.
b. Metraflex Co.

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. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

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. 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: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

F. 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. 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.

B. 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. T-drill system for mechanically formed tee connections and couplings, and Victaulic hole cut piping system are not allowed.

J. Install piping to allow application of insulation.

K. Piping shall not project beyond walls or steel lines nor shall it hang below slabs more than is absolutely necessary. Particular attention shall be paid to the required clearances.

L. Offset piping where required to avoid interference with other work, to provide greater headroom or clearance, or to conceal pipe more readily. Offsets shall be properly drained or trapped where necessary.

M. Provide swing joints and expansion bends wherever required to allow the piping to expand without undue stress to connections or equipment.

N. Isolate pipe from the building construction to prevent transmission of vibration to the structure and to eliminate noise.

O. Exposed piping around fixtures or in other conspicuous places shall not show tool marks at fittings.

P. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

Q. Select system components with pressure rating equal to or greater than system operating pressure.

R. Eccentric reducing couplings shall be provided in all cases where air or water pockets would otherwise occur due to a reduction in pipe size. Eccentric couplings shall make the pipe flush on the top for water lines.

S. 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. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
    f. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
    g. 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. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
c. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
d. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with rough-brass finish.
e. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
f. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

T. All pipes extending through the roof shall be flashed with six pound lead flashing extending 6 inches beyond the pipe, welded to a lead sleeve extended up around the vent pipes, and rolled over into the pipe.

U. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Sleeves placed in floors shall be flush with the ceiling and shall have planed, square ends, extending 2 inches above the finished floor, unless otherwise specified or detailed.
2. Where sleeves pass through reinforced concrete floors, they shall be properly set in position before the concrete is poured, and shall be maintained in position by the Contractor until the concrete is set.
3. Sleeves placed in concrete beams shall be flush with the side of the beam and large enough to accommodate the bare pipe only. All other sleeves shall be of adequate size to accommodate pipe insulation undiminished in size.
4. Pipes passing through above grade floor slabs and masonry walls shall have the space between the pipe or insulation and the sleeve packed with non-asbestos wicking or other suitable, approved, non-combustible material.
5. Pipes passing through walls of Mechanical Equipment Rooms shall be made gas-tight by caulking the space between the pipe and sleeve with a fiber saturated with an approved type of plastic material.

V. Aboveground, Exterior-Wall Pipe 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.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) 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.

W. 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 " Firestopping" for materials.

X. Verify final equipment locations for roughing-in.

Y. 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. 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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. 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.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

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.

B. Unions shall be used in preference to couplings where their use will facilitate dismantling the pipe for maintenance.

C. Install transition couplings at joints of dissimilar piping.

D. No Uni-flange pipe adapters will be allowed.

3.5 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.

C. Field Welding: Comply with AWS D1.1.

3.6 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

END OF SECTION 22 05 00

SECTION 22 05 17

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 systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: Only for products used.

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 Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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, provide products by one of 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: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Presealed Systems.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 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 (34.5-MPa), 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 (25-mm) 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 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 (50 mm) 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 (6.4-mm) 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 Section 079200 "Joint Sealants " for interior renovations

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 Section 078413 "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 (6.4-mm) 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 Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) 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 Section 078413 "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 above Grade:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

    a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves, PVC-pipe sleeves, Stack-sleeve fittings, Molded-PE or -PP sleeves, Molded-PVC sleeves.
    b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves, PVC-pipe sleeves, Stack-sleeve fittings.

5. Interior Partitions:

    a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves, PVC-pipe sleeves.
    b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 22 05 17

SECTION 22 05 23

GENERAL-DUTY VALVES 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. Brass ball valves.
2. Bronze swing check valves.
3. Bronze gate valves.

B. Related Sections:

1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.

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. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

1.4 ACTION SUBMITTALS

A. Product Data: Only for products used.

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 B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 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.

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.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

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 (50-mm) stem extensions and the following features:

1. Gate Valves: With rising stem.
2. 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. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

F. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. DynaQuip Controls.
d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

B. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hammond Valve.
b. Jamesbury; a subsidiary of Metso Automation.
c. Legend Valve.
d. Marwin Valve; a division of Richards Industries.
e. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).

d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Regular.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corporation.
i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.

d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

C. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corporation.
i. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.4 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

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 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.

E. Install chainwheels on operators for ball gatevalves NPS 4 (DN 100) and larger and more than 96 inches above floor. Extend chains to 60 inches (1520 mm) > above finished floor.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Lift Check Valves: With stem upright and plumb.

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, gate, or plugvalves.
2. Pump-Discharge Check Valves:

a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze nonmetallicdisc.
b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilientseat check 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 (DN 50) 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 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

7. For Grooved-End Copper Tubing and Steel PipingValve ends may be grooved.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass with brass trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: Class 125, NRS or RS.

END OF SECTION 22 05 23

SECTION 22 05 29

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 and Supplementary 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. Pipe stands.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing 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: Only for products used.

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**.

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 & Conduit.
b. Cooper B-Line, Inc.
c. Flex-Strut Inc.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut Corporation; Tyco International, Ltd.

g. Wesanco, Inc.

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: Hot-dipped galvanized.
8. Paint Coating: Alkyd.
9. Plastic Coating: PVC.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) 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 (50 mm) 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.

B. Mechanical-Expansion Anchors: Insert-wedge-type**,** stainless-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.

2.6 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.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 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 (34.5-MPa), 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 (100 mm) 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. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. 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.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. 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 (DN 65) 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.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. 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.

O. 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.
    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 (DN 100) 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 (DN 100) 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 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
    c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

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 (40 mm**)**.

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 (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in [Section 099600 "High-Performance Coatings."

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 attachments for copper piping and tubing.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. 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 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. 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 (DN 24 to DN 600).

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

J. 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 (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) 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 (49 to 232 deg C) piping installations.

K. 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. C-Clamps (MSS Type 23): For structural shapes.
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. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
12. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
13. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. 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.

M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.

1.3 ACTION SUBMITTALS

A. Product Data: Only for products used.

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. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving,1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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.

B. 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.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) 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 (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 (38 mm) high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) 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 (A4) 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.

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 as per Pipe Color Code ANSI/ASME A13.1

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 (15 m) along each run. Reduce intervals to 25 feet (7.6 m) 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: Blue.
   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 (38 mm), round.
b. Hot Water: 1-1/2 inches (38 mm), round.

2. Valve-Tag Color:

a. Cold Water: Natural.
b. Hot Water: Natural.

3. Letter Color:

a. Cold Water: Black.
b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 07 19

PLUMBING PIPING INSULATION

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 insulating the following plumbing piping services:

1. Domestic cold water piping.
2. Domestic hot water piping.
3. Domestic recirculating hot water piping.
4. Domestic chilled water piping for drinking fountains.
5. Sanitary waste piping exposed to freezing conditions.
6. Storm water piping exposed to freezing conditions.
7. Supplies and drains for handicap accessible lavatories and sinks

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation".

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM).

B. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE).

C. North American Insulation Manufacturers Association (NAIMA).

D. NAIMA – "Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation".

E. "National Commercial & Industrial Insulation Standards" – MICA Manual.

F. Thermal Insulation Association of Canada (TIAC).

G. National Fire Protection Association (NFPA).

H. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

I. Underwriter's Laboratories (UL).

J. Underwriter's Laboratories Environment (UL Environment).

K. ASHRAE 189.1 – “Standard for the Design of High-Performance Green Buildings Except
Low-Rise Residential Buildings”.

L. California Department of Public Health - "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers". Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less, except for insulation manufactured without formaldehyde.

1.4 DEFINITIONS

A. Thermal Conductivity (K value): Heat flow property of a homogeneous material; the lower the “k” the better the insulating value. Expressed in units of Btu-inch/hour per square foot per degree F.

B. Underwriters Laboratories Environment (UL Environment): independent, third-party green claims validation, product assessment and certification.

1. Environmental Claim Validation (ECV): Independent third-party review to single attribute environmental claims.

a. Formaldehyde Free: Independent third-party validation of claim that a product does not contain formaldehyde (or formaldehyde precursors) using a combination of auditing raw material input and testing of chemical emission from the product.

b. Recycled Content:

1. Pre-Consumer - materials used or created from one manufacturing process which are collected as scrap and placed back into another manufacturing process rather than being placed in a landfill or incinerated.
2. Post-Consumer - materials such as bottled glass collected at curbside or other collection sites after consumer use.

2. GREENGUARD Certification: Health based emission testing criteria for chemicals; requiring total VOC emission levels for products.
3. GREENGUARD Gold: Emission testing criteria for chemicals requiring lower total VOC emission limit levels for products acceptable for use in

environments such as schools and healthcare facilities. Complies with California's Department of Public Health (CDPH) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers"; Version 1.1 (2010), also known as California Section 01350 .

4. Environmental Product Declaration (EPD): Independently verified and registered document providing information about the life-cycle impact of products.

C. Health Product Declaration (HPD): Product disclosure document containing an inventory of the contents of a product for its end use and the associated health hazards.

D. EPA: Environmental Protection Agency.

E. WHO: World Health Organization.

F. ILFI: International Living Institute; an international sustainable building certification program.

1. DECLARE: Ingredients label for Building Products

a. Red List Free: 100% ingredients disclosure to 100 ppm to not contain any Red List chemicals of concern.
b. LBC Red List Compliant: Ingredients disclosure to meet 99% of Red List chemicals at 100 ppm and may contain one or more exceptions for meeting Living Building Challenge (LBC) criteria.
c. Declared: 100% ingredients disclosure to 100 ppm, but contains one or more Red List chemicals that are covered by an existing exception.

G. LEED: Leadership in Energy and Environmental Design, a voluntary rating system for high performance green buildings developed by the US Green Building Council (USGBC).

H. Sustainable Minds (SM) Transparency Catalog: Designed as an educational marketing platform to provide access to products with environmental and material disclosures that qualify for Collaborative for High Performance Schools, LEED v4, Green Globes, the Well Building Standard and the Living Building Challenge -– from all manufacturers, all program operators and all material disclosure rating systems. Available at: **www.transparencycatalog.com/showroom/knauf-insulation**.

I. EUCEB: The European Certification Board for Mineral Wool Products, a voluntary certification of the conformity to meet the bio-solubility criteria of mineral wool fibers.

J. Polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE fire retardants: used in the manufacture of some insulation facings.

K. UL Classified: Underwriters Laboratory product label of fire resistance testing that includes
on-going evaluation of the product to assure it continues to meet the Fire Hazard

Classification (FHC) 25 Flame Spread/50 Smoke Developed rating; unlike other FHC testing which is a
one-time only test.

L. ASJ+: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film layer leaving no paper exposed.

M. ASJ: All Service Jacket (no outer film).

N. SSL+: Self-Sealing Lap with Advanced Closure System.

O. SSL: Self-Sealing Lap.

P. FSK: Foil Scrim Kraft; jacketing.

Q. PSK: Poly Scrim Kraft; jacketing.

R. PVC: Poly Vinyl Chloride.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water vapor permeance, thickness, and jackets (both factory and field-applied, if any).

B. EPD or HPD Submittals: Third Party Validated.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

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.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches (300 mm) long by NPS 2 (DN 50).
2. Jacket Materials for Pipe: 12 inches (300 mm) long by NPS 2 (DN 50).
3. Sheet Jacket Materials: 12 inches (300 mm) square.

4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. 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.

C. Field quality control reports.

1.7 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. Bio-Based Binder: a plant based sustainable chemistry bond that holds the Glass Mineral Wool product together; replacing the phenol/formaldehyde (PF) binder traditionally used in Glass Mineral Wool products.

C. Surface Burning Characteristics: For insulation and related materials UL/ULC Classified per UL 723 or meeting ASTM E 84 by a testing 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 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.

D. Products shall not contain formaldehyde, asbestos, lead, mercury, or mercury compounds. Products shall be Certified UL GREENGUARD Gold or Indoor Advantage Gold.

E. Biosoluble Fiber: Certified by European Certification Board for Mineral Wool Products (EUCEB).

F. Recycled Content: A minimum of 50 percent recycled glass content certified and UL Validated.

G. Declare LBC Red List Compliant; minimum.

H. Products shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE fire retardants; whenever available.

I. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:

a. One 10 foot (3 m) section of NPS 2 (DN 50) straight pipe.
b. One each of a 90 degree threaded, welded, and flanged elbow.
c. One each of a threaded, welded, and flanged tee fitting.
d. One NPS 2 (DN 50) or smaller valve, and one NPS 2-1/2 (DN 65) or larger valve.
e. Four support hangers including hanger shield and insert.
f. One threaded strainer and one flanged strainer with removable portion of insulation.
g. One threaded reducer and one welded reducer.
h. One pressure temperature tap.
i. One mechanical coupling.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

1.8 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.

1.9 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment".

B. Coordinate clearance requirements with piping Installer for piping 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.

C. Coordinate installation and testing of heat tracing.

1.10 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 "Piping Insulation Schedule, General", "Indoor Piping Insulation Schedule", "Outdoor, Aboveground Piping Insulation Schedule", and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Insulation materials applied to carbon steel shall be Mass Load Corrosion Rate (MLCR) tested per ASTM 1617.

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. Products shall comply with the standards in Section 1.7 – Quality Assurance.

F. Glass Mineral Wool Blanket Insulation: Glass Mineral Wool bonded with a bio-based thermosetting resin. Comply with ASTM C 553, Types I, II, and III; ASTM C 1136 Type II, and ASTM C 1290, Type III. UL/UL Classified per UL 723 for FSK; FHC 25/50 per ASTM E 84 for PSK only. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; Atmosphere Duct Wrap.

G. Glass Mineral Wool, Preformed Pipe Insulation: Glass Mineral Wool bonded with a bio-based thermosetting resin. Type I, 850 deg. F (454 deg. C) or Type IV 1000 deg. F (538 deg. C). UL/ULC Classified per UL 723. Comply with ASTM C 585, ASTM C 411, ASTM C 795, and ASTM C 547, Type I, and Type IV, without factory-applied jacket.

Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; Earthwool 1000 Degree Pipe Insulation.

H. Glass Mineral Wool Pipe and Tank Insulation: Glass Mineral Wool bonded with a bio-based thermosetting resin. Semi-rigid 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. Compressive Strength per ASTM C 165, not less than 102 PSF
(5.75 kPa) at 10% deformation. Thermal conductivity (k-value) at 100 deg. F (38 deg. C) is 0.26 Btu x in. /h x sq. ft. x deg. F (0.037 W/m x C) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; Earthwool Pipe and Tank Insulation.

I. Glass Mineral Wool Pipe and Tank Insulation: Glass Mineral Wool bonded with a thermosetting resin. Semi-rigid blanket material with factory-applied FSK jacket, complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Compressive Strength; per ASTM C 165, not less than 25 PSF (1.2 kPa) at 10% deformation. Thermal conductivity (k value) at 100 deg. F (38 deg. C) is 0.25 Btu x in. /h x sq. ft. x deg. F (0.036 W/m x C). Factory-applied jacket requirements are specified in “Factory-Applied Jackets” Article.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; Kwik-Flex Pipe and Tank Insulation.

2.2 INSULATING CEMENTS

A. Mineral Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

2.3 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. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive 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".

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive 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. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive 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".

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Water Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.04 perm (0.026 metric perm) at 40 mil (1.16 mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg. F (Minus 29 to plus 82 deg. C).
3. Solids Content: ASTM D 1644, 52 percent by volume and 62 percent by weight.
4. Color: White.

C. Vapor Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Water Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35 mil (0.9 mm) dry film thickness.
2. Service Temperature Range: 0 to 180 deg. F (Minus 18 to plus 82 deg. C).
3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. Color: White.

D. Vapor Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Water Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30 mil (0.8 mm) dry film thickness.

2. Service Temperature Range: Minus 50 to plus 220 deg. F (Minus 46 to plus 104 deg. C).
3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
4. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water Vapor Permeance: ASTM F 1249, 1.8 perm (1.2 metric perm) at 0.0625 inch
(1.6 mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg. F (Minus 29 to plus 82 deg. C).
3. Solids Content: 50 percent by volume and 58 percent by weight.
4. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Fire resistant, water based lagging adhesive and coating for use indoors to adhere fire resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg. F (Minus 18 to plus 82 deg. C).
4. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg. F (Minus 73 to plus 149 deg. C).
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants 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".

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire and water resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg. F (Minus 40 to plus 121 deg. C).
4. Color: Aluminum.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants 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".

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire and water resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg. F (Minus 40 to plus 121 deg. C).
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants 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".

2.7 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+-SSL+: ASJ+ jacket with Self-Sealing Advanced Closure System; complying with ASTM C 1136 Type I, II, III, IV, and VII secured with self-sealing longitudinal laps and matching ASJ+ butt wraps.
2. ASJ+: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film leaving no paper exposed; complying with ASTM C 1136 Type I, II, III, IV, and VII.
3. ASJ: White, kraft paper, fiberglass reinforced scrim with aluminum foil backing; complying with ASTM C 1136, Type I.
4. ASJ-SSL: ASJ with self-sealing, pressure sensitive, acrylic based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
5. FSK Jacket: Aluminum foil, fiberglass reinforced scrim with kraft paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED FABRIC REINFORCING MESH

A. Woven Glass Fiber Fabric: Approximately 2 oz. /sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and pre-sized a minimum of 8 oz. /sq. yd. (271 g/sq. m).

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High impact resistant, UV resistant PVC complying with ASTM D 1784, 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: Color selected based on system.

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.

C. Laminated Self-Adhesive Water and Weather Seals:

1. Products: Subject to compliance with requirements.
2. Laminated self-adhesive seal: Meeting or exceeding the requirements of UL 723.

a. Permanent acrylic self-adhesive system.
b. Weather resistant.
c. High puncture and tear resistant.
d. Applied in strict accordance with manufacturer's recommendations.

2.11 TAPES

A. ASJ Tape: White vapor retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; EXPERT Tapes ASJ Tape or ASJ+ Tape.
2. Width: 3 inches (75 mm) or 4 inches (102 mm).
3. Thickness Total: 14.3 mil (0.36 mm) for ASJ.
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 Lbf/inch (7.2 N/mm), 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. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; EXPERT Tapes, FSK Tape.
2. Width: 3 inches (75 mm) or 4 inches (102 mm).
3. Thickness: 13.3 mil; (0.34 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 Lbf/inch (7.2 N/mm), 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. Width: 2 inches (50 mm).
2. Thickness: 6 mil; (0.15 mm).
3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 Lbf/inch (3.3 N/mm), in width.

D. Aluminum Foil Tape: Vapor retarder tape with acrylic adhesive.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; EXPERT Tapes, 2 Mil Foil Tape.
2. Width: 2 inches (50 mm).
3. Thickness: 7.3 mil; (0.19 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 Lbf/inch (6.2 N/mm), in width.

2.12 SECUREMENTS

A. Staples: Outward clinching insulation staples, nominal ¾ inch (19 mm) wide, stainless steel or Monel.

2.13 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Description: Manufactured plastic wraps for covering plumbing fixture hot and cold water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Description: Manufactured plastic enclosure for covering plumbing fixture hot and cold water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. 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 mil (0.127 mm) thick and an epoxy finish 5 mil (0.127 mm) thick if operating in a temperature range between 140 and 300 deg. F (60 and 149 deg. C). 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 (0 and 149 deg. C) 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.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 PENETRATIONS

A. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations 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 (50 mm).
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.

1. Comply with requirements in Section 078413 " Firestopping" for firestopping and fire resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire rated assemblies. Comply with requirements in Section 078413 " Fire-stopping".

3.4 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of 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 non-self-sealing factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3 inch (75 mm) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) oc.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive longitudinal lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm).

    a. For below ambient services, apply vapor barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, 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. Install insulation with self-sealing factory-applied jackets as follows:

1. Locate all longitudinal pipe insulation jacketing laps in least visible location.
2. Draw jacket tight and smooth.
3. For proper sealing, seal lap joints with reasonable pressure being applied with a plastic squeegee or sealing tool.
4. Vapor seal all circumferential joints with factory furnished matching pressure sensitive butt strips installed with reasonable pressure being applied with a plastic squeegee or sealing tool.

N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

Q. 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.

3.5 GLASS MINERAL WOOL INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes.

1. Secure pipe insulation to pipe using self-sealing lap system.
2. On high temperature piping, above 500 deg. F (260 deg. C), apply insulation using double layer and staggered joints. For double layer installation, secure the unjacketed inner layer using filament tape; without deforming insulation material. All joints and ends must be firmly butted and secured with appropriate securing material.
3. Firmly rub all longitudinal and circumferential joints using a squeegee or sealing tool.
4. Longitudinal jacket laps for pipe insulation installed on piping systems with operating temperatures below ambient shall be vapor sealed with factory-applied pressure sensitive adhesive vapor retarder, self-sealing lap. For proper sealing,

firmly rub lap joints with reasonable pressure being applied with a plastic squeegee or sealing tool. Vapor seal all circumferential joints with factory-furnished, matching pressure sensitive butt strips installed with reasonable pressure being applied with a plastic squeegee or sealing tool. Additionally, coat raw edges of pipe insulation sections with vapor retarder mastic at 12 foot (3.6 m) to 21 foot (6.4 m) intervals; at Engineer's discretion on straight piping, and on either side of all fittings, flanges, or valves. Vapor retarder mastic shall completely coat the ends of the pipe and extend onto the bore of the pipe insulation and onto the jacketing a minimum of 2 inches (51 mm). Follow NAIMA's "Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation" for additional details.

5. Install metal shields between hangers or supports and the pipe insulation. Install rigid insulation inserts as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation, and shall be vapor sealed as required. Insulation shields shall be no less than the following lengths:

    a. 1-1/2 inch (38 mm) to 2-1/2 inch (64 mm) IPS: 10 inch (254 mm) long.
    b. 3 inch (76 mm) to 6 inch (152 mm) IPS: 12 inch (305 mm) long.
    c. 8 inch (203 mm) to 10 inch (254 mm) IPS: 16 inch (406 mm) long.
    d. 12 inch (305 mm) and over IPS: 22 inch (559 mm).

6. For piping subject to abuse in mechanical rooms or high traffic areas, protect insulation from mechanical abuse by the use of appropriate thickness of PVC jacketing, metal jacketing, or laminated self-adhesive water and weather seal.

7. For piping exposed to the elements, install a jacket that shall be UV resistant PVC with a minimum thickness of 0.030 inch (0.7 mm), a minimum 0.016 inch (0.406 mm) thick aluminum jacket with factory-applied moisture barrier, or a minimum 0.010 inch (0.254 mm) thick stainless steel jacket with factory-applied moisture barrier. Fittings shall be of similar materials or outdoor weatherable PVC. Apply all jacketing per manufacturer's recommendations for the conditions.

B. Insulation Installation for 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 Glass Mineral Wool blanket insulation.
4. Install jacket material using manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed formaldehyde free Glass Mineral Wool fittings; minimum 50 percent recycled glass content, 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 Fittings:

1. Install preformed formaldehyde free Glass Mineral Wool fittings; minimum 50 percent recycled glass content, 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 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.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where glass cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2 inch (50 mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062 inch (1.6 mm) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation using manufacturer's recommended adhesive.
4. Install jacket with 1-1/2 inch (38 mm) laps at longitudinal seams and 3 inch (75 mm) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor retarder jackets and exposed insulation with vapor barrier mastic.

C. Where PVC jackets are indicated, install with minimum 1inch (25 mm) overlap at longitudinal seams and end joints. Seal using 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.

D. Where metal jackets are indicated, install with minimum 2 inch (50 mm) 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 (300 mm) oc. and at end joints.

E. Where Laminated Self-Adhesive Water and Weather Seals are indicated, install in strict compliance with manufacturer's recommended installation procedures.

3.7 FINISHES

A. Insulation with ASJ, ASJ+, Glass Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099123 "Interior Painting". NOTE: Painting MAY affect the FHC Classification of the Jacketing material.

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. Color: Final color as selected by Engineer/Owner. Vary first and second coats to allow visual inspection of the completed Work.

C. 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 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.

B. 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.

3.10 INDOOR PIPING INSULATION SCHEDULE– PER CURRENT ASHRAE 90.1 STANDARD AND/OR IECC STANDARD

A. Domestic Cold Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be the following:

a. Glass Mineral Wool: Preformed Pipe, Type I or Type IV: 1/2 inch (13 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be the following:

a. Glass Mineral Wool: Preformed Pipe, Type I or Type IV: 1 inch (25 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be the following:

a. Glass Mineral Wool: Preformed Pipe, Type I or Type IV: 1 inch (25 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be the following:

a. Glass Mineral Wool: Preformed Pipe, Type I or Type IV: 1-1/2 inch (38 mm) thick.

C. Storm water and Overflow:

1. All Pipe Sizes: Insulation shall be the following:

a. Glass Mineral Wool: Preformed Pipe, Type I or Type IV: 1 inch (25 mm) thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be the following:

a. Glass Mineral Wool: Preformed Pipe, Type I or Type IV: 1 inch (25 mm) thick.

E. 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. Glass Mineral Wool: Preformed Pipe, Type I or Type IV: 1 inch (25 mm) thick.

3.11 INDOOR, 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. If more than one material is listed, selection from materials listed is Contractor's option.

END OF SECTION 22 07 19

SECTION 22 11 16

DOMESTIC WATER 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. Under-building and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

B. ACTION SUBMITTALS

B. Product Data: For transition fittings and dielectric fittings.

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products 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".

B. Warranty Information:

1. Piping manufacturer shall submit documentation of 10-year warranty with coverage for parts, materials, labor, property damage and personal injury.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

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.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 POLYPROPYLENE (PP-R) PIPE AND FITTINGS FOR WATER DISTRIBUTION AND WATER SERVICE

A. Polypropylene Pipe: ASTM F 2389, pipe pressure rating shall comply with temperature and pressure ratings per the plumbing code requirements for the applicable service water distribution.

1. Polypropylene Fittings: ASTM F 2389, socket fusion, butt fusion, electrofusion, or fusion outlet fittings shall be used for fusion weld joints between pipe and fittings.
2. Mechanical fittings and transition fitting shall be used where transitions are made to other piping materials or to valves and appurtenances.
3. Polypropylene pipe shall not be threaded. Threaded transition fittings per ASTM F 2389 shall be used where a threaded connection is required.

B. Basis-of-design product: Subject to compliance with requirements, provide products by Aquatherm, Inc. or comparable product by one of the following:

1. Auquatherm

2.3 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. 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.

G. Copper Pressure-Seal-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Elkhart Products Corporation.
NIBCO Inc.
Viega.

2. Fittings for NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
3. Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Appurtenances for Grooved-End Copper Tubing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Anvil International
Shurjoint Piping Products
Victaulic Company

2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.

3. Mechanical Couplings for Grooved-End Copper Tubing:

Copper-tube dimensions and design similar to AWWA C606.
Ferrous housing sections.
EPDM-rubber gaskets suitable for hot and cold water.
Bolts and nuts.
Minimum Pressure Rating: 300 psig (2070 kPa).

2.5 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. 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.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.6 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.

C. Sleeve-Type Transition Coupling: WWA C219.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cascade Waterworks Manufacturing

b. Dresser, Inc.; Piping Specialties Products
c. Ford Meter Box Company, Inc. (The)
d. JCM Industries
e. Romac Industries, Inc.
f. Smith-Blair, Inc.; a Sensus company
g. Viking Johnson

D. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aguatherm, Inc.
b. Charlotte Pipe and Foundry Company
c. Harvel Plastics, Inc.
d. Spears Manufacturing Company

3. Description:

a. Polypropylene (PP-R) fitting with brass, copper, or stainless steel insert for threaded, grooved, or solder connection.

b. One end with threaded brass insert and one threaded end.

E. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aquatherm, Inc.
b. Colonial Engineering, Inc.
c. NIBCO Inc.
d. Spears Manufacturing Company

2. Description:

a. Polypropylene (PP-R) fitting with brass or stainless steel insert for threaded or grooved connection.
b. Brass or stainless-steel threaded end.
c. Rubber O-ring
d. Union nut

2.7 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 Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company; member of the Phoenix Forge Group
b. Central Plastics Company
c. Hart Industries International, inc.
d. Jomar International
e. Matco-Norca
f. McDonald, A. Y. Mfg. Co.
g. Watts; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn Company

2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C)
4. 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; member of the Phoenix Forge Group.
    b. Central Plastics Company.
    c. Matco-Norca.
    d. Watts; a division of Watts Water Technologies, Inc.
    e. Wilkins; a Zurn company.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C)
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company
    d. Pipeline Seal and Insulator, Inc.

2. Non-conducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psid (1035 kPa).
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Elster Perfection Corporation.
    b. Grinnell Mechanical Products; Tyco Fire Products LP.
    c. Matco-Norca.
    d. Precision Plumbing Products, Inc.
    e. Victaulic Company

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 200 psig (2070 kPa) at 225 deg F (107 deg C)
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 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 ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install domestic water piping level and plumb.

E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

F. 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.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping to permit valve servicing.

I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install PEX piping with loop at each change of direction of more than 90 degrees.

M. Install unions in copper tubing at final connection to each piece of equipment, machine and specialty.

N. Install sleeves for piping penetrations of walls, ceilings and floors. Comply with requirements for sleeves specified in Section 220517 “Sleeves and Sleeve Seals for Plumbing Piping”.

O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 “Sleeves and Sleeve Seals for Plumbing Piping”.

P. Install escutcheons for piping penetrations of walls, ceilings and floors.

3.2 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. 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.
3. Do NOT thread polypropylene pipe. Use threaded transition fitting.

D. Fusion Joints: Fusion join polypropylene pipe in accordance with ASTM D2657, ASTM F2389, and the manufacturer’s instructions.

E. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

F. Soldered Joints for Copper Tubing: 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."

G. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

H. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

I. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

J. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606 roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

K. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9

L. Joints for PEX Piping: Join according to ASTM F 1960.

M. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings or unions.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100). Use dielectric flanges.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products and installation in Section 220529 “Hngers and Supports for Plumbing Piping and Equipment”.

1. Vertical Piping: MSS Type 8 or 42 clamps.
2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) 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 one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
7. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

E. Install supports for vertical copper tubing every 10 feet (3 m).

F. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 (DN 25) and Smaller: 32 inches (815 mm) with 3/8-inch (10-mm) rod.

G. Install hangers for vertical PEX piping every 48 inches (1200 mm).

H. Install hangers for vertical PEX piping every 48 inches (1200 mm).

I. Install vinyl-coated hangers, or other hangers, suitable for PP piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13 mm) rod.
4. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200) with 5/8-inch (16-mm) rod.
5. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
6. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
7. For fiberglass-reinforced PP piping, hanger spacing shall be per the manufacturer’s specifications.

K. Install supports for vertical PP piping every story, and a mid-story guide for sizes NPS 2 (DN 50) and smaller.

L. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for 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. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. 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 (DN 65) and larger.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. 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:

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 authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. 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.
c. 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.
d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Hydrostatic testing and documentation of test results for polypropylene piping shall be in accordance with the manufacturer's instructions and submitted to the manufacturer upon successful completion per warranty requirements.
f. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
g. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 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 hot-water flow 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.

3.9 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 (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-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 procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.10 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. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 DN 100 to DN 200 and larger, shall be one of the following:

1. Polypropylene (PP-R), ASTM F 2389, pipe and socket fusion, butt fusion, fusion outlet or electrofusion fittings.
2. Mechanical-joint, ductile-iron pipe; standard or compact pattern, mechanical joint fittings; and mechanical joints.
3. Push-on-joint, ductile-iron pipe; standard or compact pattern, push-on-joint fittings; and gasketed joints.
4. Plain-end, ductile-iron pipe; groove-joint, ductile-iron-pipe appurtenances; and grooved joints.

E. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:

1. Polypropylene (PP-R), ASTM F 2389, pipe and socket fusion, butt fusion, fusion outlet or electrofusion fittings.
2. Hard copper tube, ASTM B 88, Type L wrought-copper, solder-joint fittings; and soldered joints.
3. Hard copper tube, ASTM B 88, Type L copper pressure-seal-joint fitings; and pressure-sealed joints.
4. PEX tube, NPS 2 (DN 50) and smaller; cold expandable fittings for PEX tube.

F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be one of the following:

1. Polypropylene (PP-R), ASTM F 3489, pipe and socket fusion, butt fusion, fusion outlet or electrofusion fittings.
2. Hard copper tube, ASTM B 88, Type L cast or wrought-copper, solder-joint fittings; and soldered joints.
3. Hard copper tube, [ASTM B 88, Type L copper pressure-seal-joint fittings; and pressure-sealed joints.

4. Hard copper tube, ASTM B 88, Type L grooved-joint, copper-tube appurtenances;; and grooved joints.
5. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
6. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

G. Aboveground domestic water piping, NPS 5 to NPS 8 (DN 125 to DN 200), shall be one of the following:

1. Polypropylene (PP-R), ASTM F 2389, pipe and socket fusion, butt fusion, fusion outlet or electrofusion fittings.
2. Hard copper tube, ASTM B 88, Type L (ASTM B 88, Type B); cast or wrought-copper, solder-joint fittings; and brazed soldered joints.
3. Hart copper tube, ASTM B 88, Type L grooved-joint, copper-tube appurtenances; and grooved joints.
4. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
5. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

3.11 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 or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) 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 22 11 16

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SECTION 22 11 19

DOMESTIC WATER 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. Section Includes:

1. Vacuum breakers.
2. Temperature-actuated, water mixing valves.
3. Strainers.
4. Specialty valves.
5. Flexible connectors.

1.3 ACTION SUBMITTALS

A. Product Data: Only for products used.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
b. Cash Acme; a division of Reliance Worldwide Corporation.
c. Conbraco Industries, Inc.
d. FEBCO; a division of Watts Water Technologies, Inc.
e. Rain Bird Corporation.
f. Toro Company (The); Irrigation Div.
g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
h. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Arrowhead Brass Products.
b. Cash Acme; a division of Reliance Worldwide Corporation.
c. Conbraco Industries, Inc.
d. Legend Valve.
e. MIFAB, Inc.
f. Prier Products, Inc.
g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
h. Woodford Manufacturing Company; a division of WCM Industries, Inc.
i. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
j. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
b. Conbraco Industries, Inc.
c. FEBCO; a division of Watts Water Technologies, Inc.

d. Flomatic Corporation.
e. Toro Company (The); Irrigation Div.
f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
g. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle third of flow range.
5. Accessories:

a. Valves: Ball type, on inlet and outlet.

2.4 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. Cash Acme; a division of Reliance Worldwide Corporation.
c. Conbraco Industries, Inc.
d. Honeywell International Inc.
e. Legend Valve.
f. Leonard Valve Company.
g. Powers; a division of Watts Water Technologies, Inc.
h. Symmons Industries, Inc.
i. TACO Incorporated.
j. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
k. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig (860 kPa).
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 110 deg F.
9. Valve Finish: Chrome plated.

B. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cash Acme; a division of Reliance Worldwide Corporation.
b. Conbraco Industries, Inc.
c. Honeywell International Inc.
d. Lawler Manufacturing Company, Inc.

e. Leonard Valve Company.
f. Powers; a division of Watts Water Technologies, Inc.
g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
h. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig (860 kPa) 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.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm) .
b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch (1.14 mm).
c. Strainers NPS 5 (DN 125) and Larger: 0.10 inch (2.54 mm).

6. Drain: Pipe plug.

2.6 SPECIALTY VALVES

A. Comply with requirements for general-duty metal valves in Section 220523 "General-Duty Valves for Plumbing Piping."

B. CPVC Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Asahi/America.
c. Colonial Engineering, Inc.
d. Georg Fischer LLC; GF Piping Systems.
e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
f. IPEX.
g. NIBCO Inc.

h. Spears Manufacturing Company.
i. Thermoplastic Valves Inc.

2. Description:

a. Standard: MSS SP-122.
b. Pressure Rating and Temperature: 125 psig (860 kPa) at [73 deg F (23 deg C).
c. Body Material: CPVC.
d. Body Design: Union type.
e. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket or threaded.
f. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket socket or threaded.
g. Ball: CPVC; full port.
h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

C. PVC Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Asahi/America.
c. Colonial Engineering, Inc.
d. Georg Fischer LLC; GF Piping Systems.
e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
f. IPEX.
g. Jomar International.
h. KBI Company.
i. Legend Valve.
j. McDonald, A. Y. Mfg. Co.
k. NIBCO Inc.
l. Spears Manufacturing Company.
m. Thermoplastic Valves Inc.

2. Description:

a. Standard: MSS SP-122.
b. Pressure Rating and Temperature: 125 psig (860 kPa) at 73 deg F (23 deg C).
c. Body Material: PVC.
d. Body Design: Union type.
e. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket or threaded.
f. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket or threaded.
g. Ball: PVC; full port.
h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

D. CPVC Non-Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Valve, Inc.
    b. Asahi/America.
    c. KBI Company.
    d. Legend Valve.
    e. NIBCO Inc.
    f. Spears Manufacturing Company.
    g. Thermoplastic Valves Inc.

2. Description:

    a. Standard: MSS SP-122.
    b. Pressure Rating and Temperature: 125 psig (860 kPa) at 73 deg F (23 deg C).
    c. Body Material: CPVC.
    d. Body Design: Non-union type.
    e. End Connections: Socket or threaded.
    f. Ball: CPVC; full or reduced port.
    g. Seals: PTFE or EPDM-rubber O-rings.
    h. Handle: Tee shaped.

E. PVC Non-Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Valve, Inc.
    b. Asahi/America.
    c. Colonial Engineering, Inc.
    d. Georg Fischer LLC; GF Piping Systems.
    e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
    f. IPEX.
    g. Jomar International.
    h. KBI Company.
    i. Legend Valve.
    j. McDonald, A. Y. Mfg. Co.
    k. NIBCO Inc.
    l. Spears Manufacturing Company.
    m. Thermoplastic Valves Inc.

2. Description:

    a. Standard: MSS SP-122.
    b. Pressure Rating and Temperature: 125 psig (860 kPa) at 73 deg F (23 deg C).
    c. Body Material: PVC.
    d. Body Design: Non-union type.
    e. End Connections: Socket or threaded.
    f. Ball: PVC; full or reduced port.
    g. Seals: PTFE or EPDM-rubber O-rings.
    h. Handle: Tee shaped.

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. Flex Pression, Ltd.
4. Flex-Weld Incorporated.
5. Hyspan Precision Products, Inc.
6. Mercer Gasket & Shim, Inc.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. TOZEN Corporation.
10. Unaflex.Universal Metal Hose; a Hyspan company.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa) 250 psig (1725 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

C. 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 (1380 kPa)] [250 psig (1725 kPa)].
2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install balancing valves in locations where they can easily be adjusted.

C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

D. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve, solenoid valve and pump.

E. Install water-hammer arresters in water piping according to PDI-WH 201.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

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. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Double-check, backflow-prevention assemblies.
5. Dual-check-valve backflow preventers.

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 Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer double-check, backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 22 11 19

SECTION 22 13 16

SANITARY WASTE AND VENT 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. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.3 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.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

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 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.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.

C. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements,[provide products by one of the following:

a. ANACO-Husky.
b. Dallas Specialty & Mfg. Co.
c. Fernco Inc.
d. Matco-Norca, Inc.
e. MIFAB, Inc.
f. Mission Rubber Company; a division of MCP Industries, Inc.
g. Stant.
h. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ANACO-Husky.
b. Clamp-All Corp.
c. Dallas Specialty & Mfg. Co.
d. MIFAB, Inc.
e. Mission Rubber Company; a division of MCP Industries, Inc.
f. Stant.
g. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS (When Applicable Aboveground Only)

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

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."

E. General.

1. Do not use PVC piping in return air plenums, coordinate with HVAC/Mechanical Trade for plenums location, and other requirements.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Dallas Specialty & Mfg. Co.
2) Fernco Inc.
3) Mission Rubber Company; a division of MCP Industries, Inc.
4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

5. Pressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cascade Waterworks Mfg. Co.
2) Dresser, Inc.
3) EBAA Iron, Inc.
4) JCM Industries, Inc.
5) Romac Industries, Inc.
6) Smith-Blair, Inc.; a Sensus company.
7) The Ford Meter Box Company, Inc.
8) Viking Johnson.

b. Standard: AWWA C219.
c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
d. Center-Sleeve Material: Manufacturer's standard.
e. Gasket Material: Natural or synthetic rubber.
f. Metal Component Finish: Corrosion-resistant coating or material.

6. Dielectric Flanges:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Capitol Manufacturing Company.
2) Central Plastics Company.
3) Matco-Norca, Inc.
4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
5) Wilkins; a Zurn company.

b. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 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 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. 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 two 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.

K. 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 and other installation requirements.

L. 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 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) 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.

M. 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/A 21.5.

N. Install aboveground PVC piping according to ASTM D 2665.

O. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. 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.

B. 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.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Plastic, Nonpressure-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. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded, nonpressure transition couplings.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
4. Vertical Piping: MSS Type 8 or Type 42, clamps.
5. Install individual, straight, horizontal piping runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

6. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
7. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. 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 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
6. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

G. When applicable, install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

H. Install supports for vertical PVC piping every 48 inches (1200 mm).

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 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. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor or in pit with pit cover flush with floor.
6. 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 (DN 65) and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 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 (30 kPa). 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 (250 Pa). 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.

3.8 CLEANING AND PROTECTION

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.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) 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 CISPI hubless-piping couplings; and coupled joints.

3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger 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 heavy-duty hubless-piping couplings; and coupled joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 (DN 100) 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; heavy-duty hubless-piping couplings; and coupled joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 22 13 16

SECTION 224000

PLUMBING FIXTURES

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:

1. Faucets
2. Toilet seats.
3. Protective shielding guards.
4. Fixture supports.
5. Water closets.
6. Urinals.
7. Lavatories.
8. Kitchen sinks.

B. Related Sections include the following:

1. Division 22 Section "Drinking Fountains."

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. 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.

C. 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. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. 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.

B. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

D. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

E. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Vitreous-China Fixtures: ASME A112.19.2M.
3. Water-Closet, Flushometer Tank Trim: ASSE 1037.

F. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Faucets: ASME A112.18.1.
2. Hose-Connection Vacuum Breakers: ASSE 1011.
3. Hose-Coupling Threads: ASME B1.20.7.
4. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
5. NSF Potable-Water Materials: NSF 61.
6. Pipe Threads: ASME B1.20.1.
7. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
8. Supply Fittings: ASME A112.18.1.
9. Brass Waste Fittings: ASME A112.18.2.

G. Comply with the following applicable standards and other requirements specified for bathtub bathtub/shower and shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.

2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Faucets: ASME A112.18.1.
4. Hand-Held Showers: ASSE 1014.
5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Manual-Control Antiscald Faucets: ASTM F 444.
8. Pipe Threads: ASME B1.20.1.
9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

H. 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. Brass Waste Fittings: ASME A112.18.2.
5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

I. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Flexible Water Connectors: ASME A112.18.6.
2. Hose-Coupling Threads: ASME B1.20.7.
3. Off-Floor Fixture Supports: ASME A112.6.1M.
4. Pipe Threads: ASME B1.20.1.
5. Plastic Toilet Seats: ANSI Z124.5.
6. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 GENERAL

A. Refer to sheet P2.01 for plumbing fixture schedule.

2.2 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Plumberex Specialty Products Inc.
b. TRUEBRO, Inc.

c. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.3 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
5. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Water-Closet Supports:

1. Description: Combination carrier designed for adjustable mounting height of wall-mounting, water-closet-type fixture. Include single or double, horizontal, hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
2. Basis-of-Design Product: Wade Model W-310 and W-320.

C. Urinal Supports:

1. Description: Designed for wall-mounting. Include rectangular steel uprights with feet.
2. Basis-of-Design Product: Wade Model W-400.

D. Lavatory Supports:

1. Description: Concealed arms with non-slip locking devices for wall-mounting. Include rectangular steel uprights with feet.
2. Basis-of-Design Product: Wade Model W-520.

E. Drinking Fountain/Water Cooler Supports:

1. Description: Designed for wall-mounting. Include rectangular steel uprights with feet.
2. Basis-of-Design Product: Wade Model W-400.

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 counter-mounting fixtures in and attached to casework.

F. Install fixtures level and plumb according to roughing-in drawings.

G. 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 valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

J. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

K. Install toilet seats on water closets.

L. Install trap-seal liquid in dry urinals.

M. 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.

N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

O. 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.

P. Install shower flow-control fittings with specified maximum flow rates in shower arms.

Q. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

R. Install escutcheons at piping wall and 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."

S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant unless indicated otherwise. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants" for interior renovation.

T. Install fixtures complete with all supply, soil, waste and vent piping connections; together with all fittings, fastening devices, cocks, valves and appurtenances required to effect complete and serviceable installations.

U. Caulk all urinals and wall-hung stools with latex caulk. Do not use silicone.

V. Lavatories: Mount at 34” above the finished floor.

W. Water Closets: Mount at 15 inches above finished floor, except at 17 inches above the finished floor for accessible fixtures.

X. Urinals: Mount with the lip 24" above finished floor, except with the lip 15" above finished floor for accessible fixtures.

Y. Waterless Urinals: Mount at 17" above finished floor to lip of urinal. Center drain line shall be at 8.5" off finished floor.

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.

1. Supply Risers: Formed metal nosepiece with insert or formed nosepiece with insert gasket by Brass Craft or approved equal. Rubber gasket type compression fitting is not acceptable.
2. Supply Stops: Polished chrome-plated, stuffing box or loose-key, straight or angle style with compression or FIP inlet and compression outlet by Brass Craft or approved equal.

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.

3.6 Install fresh batteries in sensor-operated mechanisms.

3.7 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.

3.8 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 22 40 00

SECTION 22 47 13

DRINKING FOUNTAINS

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 water coolers and related components:

1. Water coolers.
2. Fixture supports.

1.3 DEFINITIONS

A. Accessible Water Cooler: Fixture that can be approached and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of fixture.

C. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

1.4 SUBMITTALS

A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For fixtures 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. 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.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

D. 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.

E. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 WATER COOLERS

A. Electric Water Coolers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Refer to sheet P2.01 for Electric Water Cooler schedule.

2. Description: Hi-Lo, barrier-free, vandal-resistant wall-mounted.

   a. Cabinet: All stainless steel.
   b. Bubbler: One, with adjustable stream regulator, located on deck.
   c. Control: Push button.
   d. Supply: NPS 3/8 with ball, gate, or globe valve.
   e. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
   f. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
   g. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, HFC refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

1) Capacity: 8 gph of 50 deg F cooled water from 80 deg F inlet water and 90 deg F ambient air temperature.
2) Electrical Characteristics: 120-V ac; single phase; 60 Hz.

2.2 FIXTURE SUPPORTS

A. 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.

B. 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: Bi-level, 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

A. 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.

B. Examine walls and floors for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.

B. Use mounting frames for recessed water coolers, unless otherwise indicated.

C. Set freestanding and pedestal drinking fountains on floor.

D. Set remote water coolers on floor, unless otherwise indicated.

E. 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

A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.

B. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.

C. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball valves. 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."

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. 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."

G. 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" for interior renovation.

3.4 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."

3.5 FIELD QUALITY CONTROL

A. 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

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust water cooler temperature settings.

3.7 CLEANING

A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 224700

INDEX OF MECHANICAL SPECIFICATIONS
FOR
ANN ARBOR WATER DEPARTMENT INTERIOR RENOVATION

SECTION 230500

COMMON WORK RESULTS FOR HVAC

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:
   1. Mechanical sleeve seals.
   2. HVAC demolition.

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Mechanical sleeve seals.
   2. Escutcheons.

1.4 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.

1.5 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. 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 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

   a. Link-Seal.
   b. Metraflex Co.

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.

PART 3 - EXECUTION

3.1 HVAC 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 HVAC systems, equipment, and components indicated to be removed.
1. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
2. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. 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 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.

END OF SECTION 230500

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Balancing Air Systems:

a. Constant-volume air systems.

2. Balancing Hydronic Piping Systems:

a. Primary-secondary hydronic systems.

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 INFORMATINAL 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. Certified TAB reports.

E. Sample report forms.

F. 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.

1.5 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. TAB Conference: Meet with Owner, Construction Manager & Commissioning Authority on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. 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.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect Owner Construction Manager Commissioning Authority.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

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 and water 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 operating safety interlocks and controls on HVAC equipment.

K. 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, or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" 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.

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. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. 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.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT/VAV-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 Architect and Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC 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.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 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.

3.7 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 weekly 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.

3.8 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. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. 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.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. 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. Face and bypass damper settings at coils.
d. Fan drive settings including settings and percentage of maximum pitch diameter.
e. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Terminal units.
4. Balancing stations.
5. Position of balancing devices.

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.

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.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Filter static-pressure differential in inches wg (Pa).
f. Outdoor airflow in cfm (L/s).
g. Return airflow in cfm (L/s).
h. Outdoor-air damper position.
i. 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. Make and model number.
f. Face area in sq. ft. (sq. m).

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).

G. 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 (deg C).
d. Duct static pressure in inches wg (Pa).
e. Duct size in inches (mm).
f. Duct area in sq. ft. (sq. m).
g. Indicated air flow rate in cfm (L/s).
h. Indicated velocity in fpm (m/s).
i. Actual air flow rate in cfm (L/s).
j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

H. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.9 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

    a. Measure airflow of at least 10 percent of air outlets.
    b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    c. Verify that balancing devices are marked with final balance position.
    d. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect, Owner, Construction Manager and Commissioning Authority.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect, Owner, Construction Manager and Commissioning Authority.
3. Commissioning Authority 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.
4. 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."
5. 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.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. 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 contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

END OF SECTION 23 05 93

SECTION 23 07 13

DUCT INSULATION

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 insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned 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 air intake duct.

B. Related Sections:
1. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance 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, dampers, specialties and flanges for each type of insulation.
3. Detail application at linkages of control devices.

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. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing 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 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 sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for plumbing piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing 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 "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground and Plenum Insulation Schedule" articles, as per latest edition of ASHRAE 90.1, for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.

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. Aeroflex USA, Inc.; Aerocel.
   b. Armacell LLC; AP Armaflex.
   c. K-Flex USA; Insul-Sheet, K-Flex Gray Duct Liner, and K-FLEX LS.

E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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. CertainTeed Corp.; SoftTouch Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Friendly Feel Duct Wrap.
   d. Manson Insulation Inc.; Alley Wrap.
   e. Owens Corning; SOFTR All-Service Duct Wrap.

F. 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. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

   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.

G. All supply ductwork inside of the building, in unconditioned spaces, shall be insulated with duct wrap of 1" minimum thickness and 1_1\2# density, with vapor barrier, and having an average “R” value of 3.5 H FT² ºF/BTH (in conformance with the latest edition of ASHRAE 90.1) insulation, with vapor barrier. Joints shall be stapled and taped.

H. All ductwork exposed outside of the building shall be covered with 1_1\2" thick, 1_1\2# density, fiberglass board with F.S.K. facing and having an average “R” value of 6 H FT² ºF/BTH (in conformance with the latest edition of ASHRAE 90.1) insulation / fiberglass board with F.S.K. facing. All joints shall be taped. Weatherproof ducts with weatherproof mastic both under and over one layer of fire retardant glass cloth with 2" overlap on all seams. Weatherproof coating shall be 1\8" thick and /or as required by the specified manufacturer installation manual.

I. VentureClad Jacketing Tape 1577CW is accepted as an alternate to regular insulated exposed outside ductwork.
   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. 3M Science Applied to life

J. Ductwork insulation shall have a flame spread\smoke density rating not exceeding 25\50 per NFPA pamphlet 90a.

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 and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

   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. Aeroflex USA, Inc.; Aeroseal.
      b. Armacell LLC; Armaflex 520 Adhesive.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.K-Flex USA; R-373 Contact Adhesive.

   2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Adhesive 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."

C. 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
    b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive 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. ASJ Adhesive, and FSK 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, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive 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."

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements,

    a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
    b. Eagle Bridges - Marathon Industries; 501.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
    d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
    b. Eagle Bridges - Marathon Industries; 570.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 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. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
b. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
4. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
5. Color: White.

2.5 SEALANTS

A. FSK and Metal 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
c. Mon-Eco Industries, Inc.; 44-05.

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 (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants 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."

B. ASJ Flashing Sealants, and Vinyl 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 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 (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants 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."

2.6 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, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) 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, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 491 AWF FSK.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   c. Compac Corporation; 110 and 111.
   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) 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, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 370 White PVC tape.
   b. Compac Corporation; 130.
   c. Venture Tape; 1506 CW NS.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

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. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   c. Compac Corporation; 120.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.7 SECUREMENTS

A. Bands:

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. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, [1/2 inch (13 mm)] wide with wing seal or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal 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- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

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; 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- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) 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.; CHP-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, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
c. Spindle: Copper- or zinc-coated, low-carbon steel or Aluminum or Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) 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, available products that may be incorporated into the Work include, but are not limited to, the following:

1) GEMCO; Nylon Hangers.
2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

b. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.
c. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
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, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
2) GEMCO; Peel & Press.
3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
c. Spindle: Copper- or zinc-coated, low-carbon steel or Aluminum or Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) 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- (0.41-mm-) thick, galvanized-steel or aluminum or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) 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.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

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) GEMCO.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.080-inch (2.0-mm) 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.

2.8 CORNER ANGLES

A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch (0.61 mm) thick, minimum 1 by 1 inch (25 by 25 mm), stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. 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.

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 ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct 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. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. 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.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

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 (50 mm) 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 (50 mm).
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: 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 (50 mm).

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

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.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. 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 (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) 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 (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) 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 (10 deg C) at 18-foot (5.5-m) 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 two times the insulation thickness, but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) 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- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

B. 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 (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) 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 (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) 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 (10 deg C) at 18-foot (5.5-m) 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 two times the insulation thickness, but not less than 3 inches (75 mm).

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- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.7 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

    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 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(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, and outdoor air.
2. Indoor, concealed supply and return located in unconditioned space.
3. Indoor, exposed supply and return located in unconditioned space.
4. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
5. Indoor, exhaust within 5 ft. of penetration of building exterior.

B. Items Not Insulated:
1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed return and supply-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density. With factory applied FSK jacket.

B. Exposed and Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.

C. Concealed and Exposed, outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches (38mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density with factory applied FSK jacket.

END OF SECTION 23 07 13

SECTION 23 31 13

METAL DUCTS

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. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "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.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Ductwork.

B. Shop Drawings:
1. Penetrations through fire-rated and other partitions.
2. Equipment system & installation based on equipment being used on Project.
3. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, 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 2-1, "Rectangular Duct/Transverse 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 2-2, "Rectangular Duct/Longitudinal Seams," 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 4, "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[AND FLAT-OVAL] 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
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product 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 3-1, "Round Duct Transverse 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."

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," 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 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "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 (Z180) , G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

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
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product 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 II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F (0.033 W/m x K) at 75 deg F (24 deg C) mean temperature.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

   a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   b. Adhesive 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."

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- (2.6-mm-) 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "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. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).
7. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
8. 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.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm (12.7 m/s) or where indicated.

9. 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 (2.4-mm) diameter, with an overall open area of 23 percent.

10. 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 (76 mm) 4 inches (102 mm) [6 inches (152 mm).

3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. 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).
11. 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."

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 (2500 Pa), 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.

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 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "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 (25 mm), 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 (38 mm).

K. 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.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.–Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "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 (500 Pa) and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): 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 Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): 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 5, "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 (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) 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 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) 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 (5 m).

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 Section 233300 "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

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.
1. Test for leaks before applying external insulation.
2. 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.

3.8 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. Ducts Connected to Terminal Units:

a. Pressure Class: Positive 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 2-inch wg (500 Pa) (1000 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 3.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 24.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg (250 Pa).
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 24.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Terminal Units:

a. Pressure Class: Positive or negative 1-inch wg (250 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "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 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "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 (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

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 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 33 00

AIR DUCT ACCESSORIES

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. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Flexible connectors.
4. Flexible ducts.
5. Duct accessory hardware.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For duct accessories.

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. Manual volume &back-draft damper installations.

1.4 INFORMATIONAL SUBMITTALS

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.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

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 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.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 (Z180).
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts.

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 (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. Flexmaster U.S.A., Inc.
   d. McGill AirFlow LLC.
   e. Nailor Industries Inc.

f. Pottorff.
g. Ruskin Company.
h. Trox USA Inc.
i. Vent Products Company, Inc.

3. Standard leakage rating, with linkage outside airstream.
4. Suitable for horizontal or vertical applications.
5. Frames:

a. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

6. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized-steel, 0.064 inch (1.62 mm) thick.

7. Blade Axles: Galvanized steel.
8. Bearings:

a. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. McGill AirFlow LLC.
d. Nailor Industries Inc.
e. Pottorff.
f. Ruskin Company.
g. Trox USA Inc.
h. Vent Products Company, Inc.

3. Standard leakage rating, with linkage outside airstream.
4. Suitable for horizontal or vertical applications.
5. Frames: Hat-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
6. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
e. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.

7. Blade Axles: Galvanized steel.
8. Bearings:

a. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Tie Bars and Brackets: Aluminum.

C. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. McGill AirFlow LLC.
d. Nailor Industries Inc.
e. Pottorff.
f. Ruskin Company.
g. Trox USA Inc.
h. Vent Products Company, Inc.

3. Comply with AMCA 500-D testing for damper rating.
4. Low-leakage rating**,** with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
5. Suitable for horizontal or vertical applications.
6. Frames:

a. Hat shaped.
b. 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
c. Mitered and welded corners.
d. Flanges for attaching to walls and flangeless frames for installing in ducts.

7. 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 (1.62 mm) thick.

8. Blade Axles: Galvanized steel.

9. Bearings:

    a. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

10. Blade Seals: Neoprene.
11. Jamb Seals: Cambered stainless steel.
12. Tie Bars and Brackets: Galvanized steel.
13. Accessories:

    a. Include locking device to hold single-blade dampers in a fixed position without vibration.

2.4 FLANGE CONNECTORS

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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product 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.

C. Description: **Add-on**, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

D. Material: Galvanized steel.

E. Gage and Shape: Match connecting ductwork.

2.5 DUCT-MOUNTED ACCESS DOORS

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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Elgen Manufacturing.
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation.

7. McGill AirFlow LLC.
8. Nailor Industries Inc.
9. Pottorff.
10. Ventfabrics, Inc.
11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

C. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - 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 (25-by-25-mm)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 (300 mm) Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.

2.6 DUCT ACCESS PANEL ASSEMBLIES

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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

C. Labeled according to UL 1978 by an NRTL.

D. Panel and Frame: Minimum thickness 0.0528-inch (1.3-mm) carbon steel.

E. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

F. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F (1093 deg C).

G. Minimum Pressure Rating: 10-inch wg (2500 Pa), positive or negative.

2.7 FLEXIBLE CONNECTORS

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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. Ventfabrics, Inc.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

C. Materials: Flame-retardant or noncombustible fabrics.

D. Coatings and Adhesives: Comply with UL 181, Class 1.

E. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

G. 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. (810 g/sq. m).
2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

H. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd. (542 g/sq. m).
2. Tensile Strength: 285 lbf/inch (50 N/mm) in the warp and 185 lbf/inch (32 N/mm) in the filling.

3. Service Temperature: Minus 67 to plus 500 deg F (Minus 55 to plus 260 deg C).

2.8 FLEXIBLE DUCTS

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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product 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.

C. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).

D. Noninsulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.

1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).

E. 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 (75 through 460 mm), to suit duct size.

2.9 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 duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
1. Where indicated.

H. Install access doors with swing against duct static pressure.

I. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).

J. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect flexible ducts to metal ducts with adhesive.

N. 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. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

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. Rectangular and square ceiling diffusers.

B. Related Sections:
   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION 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.

1.4 **I**NFORMATIONAL 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. Method of attaching hangers to building structure.
   2. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. A-J Manufacturing Co., Inc.
    b. Anemostat Products; a Mestek company.
    c. Carnes.
    d. Hart & Cooley Inc.
    e. Krueger.
    f. METALAIRE, Inc.
    g. Nailor Industries Inc.
    h. Price Industries.
    i. Titus.
    j. Tuttle & Bailey.

3. Devices shall be specifically designed for variable-air-volume flows.
4. Material: Steel.
5. Finish: Baked enamel, white.
6. Face Size: See Plans.
7. Mounting: See Plans.
8. Pattern: Adjustable.
9. Dampers: Radial opposed blade.
10. Accessories:

B. 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 23 37 13

INDEX OF ELECTRICAL SPECIFICATIONS
FOR
ANN ARBOR WATER DEPARTMENT

2018 ARCHITECTURAL AND STRUCTURAL REPAIRS

SECTION 26 00 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this and other sections of Division 16.

1.02 SUMMARY

A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in other sections of the specification.

1. Submittals.
2. Coordination drawings.
3. Record documents.
4. Maintenance manuals.
5. Rough-ins.
6. Electrical installations.
7. Cutting and patching.

B. All equipment shall be new and shall conform in all respects to the latest approved standards of the I.E.E.E., A.N.S.I. and the "UL" Label or Listing.

1.03 SUBMITTALS

A. General: Follow the procedures specified in Section 13 3000 "SUBMITTAL PROCEDURE".

1.04 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Prepare floor plans of all electrical equipment rooms and spaces, telephone rooms and spaces, generator facilities and any special electrical spaces to be installed on this project.
2. Indicate the proposed locations of major raceway systems, equipment, and

materials. Include the following:

a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
b. Exterior wall and foundation penetrations.
c. Fire-rated wall and floor penetrations.
d. Equipment connections and support details.
e. Sizes and location of required concrete pads and bases.

B. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

C. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls and ceilings and their relationship to other penetrations and installations.

D. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communications systems components, sprinklers, and other ceiling-mounted devices.

1.05 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Section 01 78 39 "PROJECT RECORD DOCUMENTS". In addition to the requirements specified in Section 01 78 39, indicate installed conditions for:

1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located to record the locations and invert elevations of underground installations.

1.06 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Section 017700 "CLOSEOUT PROCEDURES. In addition to the requirements specified in Section 017700, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting

instructions.

4. Servicing instruction and lubrication charts and schedules.

PART 2 PRODUCTS

NOT APPLICABLE

PART 3 EXECUTION

3.01 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in other Sections for rough-in requirements.

3.02 ELECTRICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate electrical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install electrical equipment to facilitate servicing, maintenance and repair or

replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Section 08 31 13 "ACCESS DOORS AND FRAMES" and Section 260520 "BASIC ELECTRICAL MATERIALS AND METHODS".
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.03 TEMPORARY SERVICE

A. The Electrical Contractor shall furnish and install temporary light and power in accordance with the progress schedule of the General Contractor.

B. The Electrical Contractor shall furnish, install, maintain and remove after construction Is completed, three-phase, four-wire temporary power and lighting system of Amperage and Voltage as required. The system shall consist of a service distribution system, panelboards, Grounding and branch circuits. Lighting fixtures shall be installed for walking lighting around entire perimeter of site. Each floor of the building shall be wired by the General Contractor to meet all code requirements. If required to provide an additional service of another voltage for testing motors, this Electrical Contractor shall furnish and install transformers of adequate size to provide such voltage. Power company charges for temporary service installation and current consumption will be paid by the General Contractor.

3.04 CUTTING AND PATCHING

A. Perform cutting, fitting, and patching of electrical equipment and materials required to:
1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing
5. Install equipment and materials in existing structures.

B. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.

C. Cut, remove and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

G. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

H. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

SECTION 26 00 10

BASIC MATERIALS & METHODS

PART 1 GENERAL

1.01 SUMMARY

A. Applicable provisions of General Conditions, Supplementary General Conditions, Special Conditions, and Instructions to Bidders govern work under this Section.

B. Drawings for the work are diagrammatic, intended to convey the Scope of the Work and to indicate the general arrangement and locations of the work. Because of the scale of the drawings, certain basic items such as conduit fittings, access panels, sleeves, pull and junction boxes may not be indicated. Where such items are required by Code or by other sections, or where they are required for proper installation of the work, such items shall be included.

C. Equipment Specification may not deal individually with minute items such as components, parts, controls and devices which may be required to produce the equipment performance specified. Where such items are required, they shall be included by the supplier of the equipment.

D. Install equipment furnished by other Sections and make required service connections. Contractor shall verify with the supplier of the equipment the requirements for the installation.

E. Contractor will inspect site before bidding project and will be responsible for existing conditions.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Section 26 05 00 "Common Work Results for Electrical" apply to work specified in this section.

1.03 STANDARDS AND CODES

A. Methods of installation shall comply with the provisions of applicable sections of the 2014 edition of the NEC, the 2014 State of Michigan Electrical Code with Part 8 amendments, the 2015 MIchigan Building Code, and the ICC Electrical Code.

B. Materials shall be UL and NEC approved for the application.

C. Secure inspections required by the Authorities with jurisdiction over the site.

1. Secure permits.

D. Where applications are required for procuring of services to the building, prepare and file such application with the proper inspection departments. This section shall furnish information required for the application in the form required by the inspection authorities.

1.04 ELECTRICAL REFERENCE SYMBOLS

A. Symbols used on the drawings are indicated in the Electrical Symbols Schedule on the Drawings. Not necessarily will all symbols scheduled be required for the project.

1.05 ACTIVE SERVICES

A. Existing active services - water, gas, sewer, telephone, telecommunications, electric when encountered, shall be protected against damage. Do not prevent or disturb operation of active services which are to remain. If active services are encountered which require relocation, make request to hospital authorities for determination of procedures. Where existing services are to be abandoned, they shall be terminated in

conformance with requirements of the utility or Municipality having jurisdiction.

1.06 TESTS

A. Systems shall be tested and placed in proper working order prior to demonstrating systems to the Owner and Architect.

B. After work is completed a load balance test shall be made to demonstrate that with full lighting load the balance between phases is within 5%. Unbalance beyond this limit shall be corrected by the Contractor.

C. System ground shall be tested to demonstrate that the ground resistance does not exceed the requirements of these documents and the NEC.

D. Perform such tests as required by authorities having jurisdiction over the site.

E. Include all test results within the final operations and maintenance manuals.

F. The Owner may elect to hire an independent testing agency to verify proper installation and operation of the main electrical service (through the 480 volt panelboard, normal and emergency). Deficiencies found by the agency shall be corrected by the Contractor at no cost to the Owner.

1.07 DEMONSTRATIONS

A. Prior to acceptance of the work, the Contractor shall demonstrate to the Owner and the Architect, all features and functions of all systems and shall instruct the Owner in the proper operation of the systems. Each system shall be demonstrated.

B. Prepare and submit to the Owner operation and service manuals at least two weeks prior to the scheduled demonstrations.

C. The demonstrations shall consist of not less than the following:
   1. Point out the actual location of each component of a system and demonstrate its function and its relationship to other components within the system.
   2. Demonstrate the electrical systems by actual "start-stop" operation showing how to work controls, how to reset protective devices, how to replace fuses, and what to do in emergency.
   3. Demonstrate fire alarm, light sensing, occupancy sensors and emergency electric systems by actual operation of the systems and show how to reset signals, alarms and detection devices.
   4. Instruct the Owner's operating and maintenance personnel and demonstrate the proper maintenance of the equipment supplied including, but not limited to:
      a. Combination motor starters and motor control equipment
      b. Panelboards
      c. Exit lighting and emergency lighting systems
      d. Transfer Switch
      e. Light Fixtures and Dimming Systems

D. Contractor shall furnish the necessary trained personnel to perform the demonstrations and instructions, and shall arrange to have the manufacturer's representatives present to assist with the demonstrations.

E. Contractor shall arrange with the Architect the dates and times for performing the demonstrations.

1.08 IDENTIFICATION

A. Provide identification for wiring systems and equipment.

B. Lettering for identification shall be of engraved laminated phenolic tags, black background with 1/2" high white lettering. Tags shall be held in place with small bolts and nuts; adhesive tape of any form shall not be acceptable. All central equipment shall be identified with phenolic tags.

C. Panelboards within equipment rooms or closets, motor and equipment controls, disconnect switches and similar equipment may be identified with one half inch black lettering in lieu of with phenolic tag. Flush mounted panels shall be lettered inside the door.

D. All major pull and junction boxes above accessible ceilings and in accessible chases shall have 1/2" black lettering identifying the feeder or system. In addition: Panelboards and boxes, as well as covers, for emergency systems shall be painted Red.

E. Equipment and panelboards shall be color coded only within equipment rooms.

F. Panelboards, equipment and boxes for emergency wiring system shall be identified with red Lettering or on a red background.

G. Systems with conductors exceeding 240 volts to ground shall have voltage identification stenciled with 1/2" high black letters on all panels, switches, pull boxes, junction boxes, and every 30' on exposed conduits. Flush panels shall be lettered inside the door. Example: "480 VOLTS".

H. Panelboards shall have typewritten circuit directories installed inside the doors under transparent plastic cover. Circuit directories shall identify, for each circuit, the type of load (lighting, outlets, equipment item) and room numbers of areas served.

J. Power Panels and Distribution Panels without doors, shall have circuit breakers and switches identified by engraved plastic tags attached to the cabinet adjacent to the device.

K. Central equipment phenolic nameplates shall be on the equipment doors.

1.11 WALL PENETRATIONS AND FIRE PROOFING

A. All penetrations of corridor walls and rated fire and smoke walls shall be by conduit. All penetration sleeves including open ended conduits not terminated in junction boxes shall be filled with Fire Safing Material as manufactured by U. S. GYPSUM CO., or Architect approved equal for 2" in length from conduit end.

1.12 PROTECTION

A. Equipment and material shall be protected from weather elements, painting, and plaster until the project is completed. All damage including rust, paint and scratches shall be repaired as required to restore equipment to original condition.

B. Where the installation or connection of equipment requires this Contractor to work in areas previously finished by other Contractors, this Contractor shall be responsible that such areas are protected and are not marred, soiled or otherwise damaged during the course of such work. This Contractor shall arrange with the other Contractors for repairing and refinishing of such areas which may be damaged. All repaired and refinished areas shall be approved by the Architect. Additional cost in this respect shall be paid for by this Contractor.

1.13 OPENINGS, CUTTING AND PATCHING

A. Contractor shall coordinate the placing of openings in the new structure as required for the installation of the Electrical Work.

B. When cutting and patching of the new structure is made necessary due to this Contractor's failure to install piping, ducts, sleeves or equipment on schedule, or due to Contractor's failure to furnish, on schedule, the information required for the leaving

of openings, then it shall be Contractor's responsibility to make arrangements, including approval of the Architect, for this cutting and patching, and this Contractor shall pay any additional cost incurred in this respect.

C. Contractor shall provide cutting and patching and patch painting in the existing structure, as required for the installation of his work, and shall furnish lintels and supports as required for openings. Cutting or core drilling of structural support members will not be permitted without prior approval of the Architect. Extent of cutting shall be minimized; use core drills, power saws or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

1.14 FINISHING

A. Prior to acceptance of the installation and final payment of the Contract, Contractor shall perform the work outlined herein.

B. Cleaning:
1. At the conclusion of the construction, the site and structure shall be cleaned thoroughly of all debris and unused materials remaining from the electrical construction. All tunnel and closed off spaces shall be cleaned of all packing boxes, wood frame members and other waste materials used in the electrical construction.
2. The entire system of panelboards, transformers, disconnect switches, emergency electric system components, combination motor starters, and all control, alarm and communication cabinets shall be cleaned internally.
3. All temporary labels and stickers shall be removed from all fixtures and equipment. (Do not remove permanent name plates, equipment model numbers, ratings.)

1.15 ACCESS PANELS

A. Provide access panels where required and not shown on the drawings for installation by the Contractor. Access panels shall be as specified in Division 8. All access panel locations shall be approved by the Architect.

1.16 COORDINATION AND COOPERATION

A. It shall be the Contractor's responsibility to schedule and coordinate his work with the schedule of the Owner so as to progress the work expeditiously, and to avoid unnecessary delays.

B. Contractor shall examine fully the Drawings and Specifications for other Contractors of other trades, and shall coordinate the installation of his work with the work of the other Contractors. Contractor shall consult and cooperate with other Contractors for determining space requirements and for determining that adequate clearance is allowed with respect to his equipment, other equipment and the building. The Owner reserves the right to determine space priority of the Contractors in the event of interference between piping, conduit, ducts and equipment of the various Contractors.

C. Conflicts between the Drawings and the Specification, or between the requirements set forth for the various Contractors shall be called to the attention of the Architect. If clarification is not asked for prior to taking bids, it will be assumed that none is required and that the Contractor is in agreement with the Drawings and Specifications as issued. If clarification is required after the Contract is awarded, such clarification will be made by the Architect and his decision will be final.

1.17 PROJECT RECORD DOCUMENTS

A. Requirements and method of preparing and procedure for submitting shall be in compliance with Division 1.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 26 05 05

SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02 STANDARDS AND CODES

A. Methods of installation shall comply with the provisions of applicable sections of the 2014 edition of the NEC, the 2014 State of Michigan Electrical Code with Part 8 amendments, the 2015 Michigan Building Code, and the ICC Electrical Code.

B. Materials shall be UL and NEC approved for the application.

PART 2 PRODUCTS

2.01 MATERIAL AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements where shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observations.

D. Report discrepancies to Owner before disturbing existing installation.

E. Report discrepancies to Architect before disturbing existing installation.

F. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during

construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 48 hours before partially or completely disabling systems.
   2. Make temporary connections to maintain service in areas adjacent to work areas.

E. Existing Low Voltage Communications Systems: Maintain existing systems in service until new systems are complete and ready for service and new services are accepted Disable systems only to make switchovers and connections. Minimize outage duration.

   1. Notify Owner at least 48 hours before partially or completely disabling any systems.
   2. Notify Low Voltage Systems contractor at least 72 hours before partially or completely disabling any system.
   3. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets and conduits servicing them. Provide blank covers for abandoned outlets which are not removed.

E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

F. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

G. Repair adjacent construction and finishes damaged during demolition and extension work.

H. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

I. Extend existing installations using materials and methods compatible with current constructions standards.

J. Luminaires: Remove existing luminaires and deliver to location as directed by building representative. All lighting fixture that the owner chooses not to retain shall be removed off site and disposed of by the electrical contractor.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 STANDARDS AND CODES

A. Methods of installation shall comply with the provisions of applicable sections of the 2014 edition of the NEC, the 2014 State of Michigan Electrical Code with Part 8 amendments, the 2015 Michigan Building Code, and the ICC Electrical Code.

B. Materials shall be UL and NEC approved for the application.

PART 2 PRODUCTS

2.01 GENERAL

A. This Section describes the basic materials and methods of installation for general wiring systems of 600 volts and less. Wiring for a higher voltage rating shall be as specified in other Sections.

B. Minimum size conductors shall be No. 12 AWG for power and lighting and No. 14 AWG for signal and control.

2.02 MATERIALS

A. The material used for the wiring systems shall be the products of a manufacturer regularly engaged In the manufacturing of the specified material. Where a manufacturer is named for a particular material, the material of other manufacturers will be acceptable provided the material meets requirements of the Specifications.

2.03 WIRE AND CABLE

A. Wire and cable for power, lighting, control and signal circuits shall have copper conductors of not less than 98% conductivity. Power lighting and control wire and cable shall be insulated to 600 volts. All conductors larger than #10 AWG shall be stranded.

B. Type of wire and cable for the various applications shall be as follows:
   1. Type THW, THWN or XHHW (75^{o}C.): Use for branch circuits, panel and equipment feeders in wet and dry locations.
   2. Type RHH, THHN or XHHW (90^{o}C.): Use for branch circuits, panel and equipment feeders in dry location only. Use where lighting branch circuit conductors are routed through fluorescent fixture channels.

3. Type TW dry and wet locations, Type "T" dry locations only (60°C.): Use for low voltage signal and control circuits operating at 25 volts or less.
4. Type A (150°C.): Use for field tap-off connections to incandescent fixture sockets and other high operating temperature equipment connections where operating temperature exceeds 90°C.
5. Type XHHW-1 (75°C.): Use for branch circuit wiring from Isolation panelboard secondaries to receptacles and equipment.
6. Type #IFN use for fire alarm wiring.

2.04 CONDUCTOR COLOR CODING

A. Wiring systems shall be color coded. Ungrounded conductor insulation shall be colored in sizes up through No. 10 AWG, conductors No. 8 AWG and larger shall have black insulation and shall be phase color coded with □" band of colored tape at all pull boxes, junctions and terminations. Colors shall be assigned to each conductor as described below and carried throughout all main and branch circuit distribution.

	120/208 Volt	277/480 Volt
1. Phase "A" Line Conductor -	Black	Brown
2. Phase "B" Line Conductor -	Red	Orange
3. Phase "C" Line Conductor -	Blue	Yellow
4. Grounded Conductor (Sizes #6 AWG or smaller)* -	White	Grey
5. Equipment Grounding Conductor (Sizes #6 or smaller)* -	Green	Green

* Refer to NEC Articles 200.6 250.119 for specific requirements and limitations.

2.05 CONNECTORS

A. In-line splices and taps for conductor sizes No. 8 AWG and smaller:Use 3M Co. ."Scotchloc" vinyl insulated spring connectors or Architect approved equivalent.

B. In-line connectors for conductor sizes No. 6 AWG and larger: Use THOMAS & BETTS two way connectors long barrel type, Series 54800 with Interlocking Covers or Architect approved equivalent.

C. Taps for conductor sizes No. 6 AWG and larger: Use THOMAS & BETTS "C" Taps, Series 54700 or Architect approved equivalent.

D. Cable terminations to bus bars, switch studs and terminal blocks: Use THOMAS & BETTS two hole lugs, long barrel type, Series 54800 or Architect approved equivalent.

E. Insulate splices and taps to thickness of conductor insulation with half-lapped layers of 3M "Scotch" brand No. 88 vinyl electrical tape or Architect approved equivalent. connectors having irregular surfaces: Fill voids and smooth contours with 3M "Scotchfil" electrical putty prior to taping.

PART 3 EXECUTION

3.01 PREPARATION

A. Wire shall not be installed in the conduit system until the building is enclosed and masonry work is completed.

B. Conduit shall be swabbed free of moisture and debris prior to pulling in wire.

3.02 INSTALLATION

A. Cable for all feeders shall be continuous from origin to termination.

B. Splices in branch circuit wires shall be made only in accessible junction boxes.

C. Power feeder cable shall be pulled with cable lubricating compound suitable for the wire insulation and conduit it is used with. Compound shall not harden or become adhesive.

D. All receptacles and equipment circuits shall be provided with a separate, green, insulated copper grounding conductor, #12 minimum run with the circuit conductors.

E. Test results shall be witnessed and signed by the Owner's Representative. One copy of each test shall be submitted to the Engineer.

F. Install wiring in raceway systems, as indicated on the Drawings and as specified, except
Where exposed or direct burial wiring is indicated or specified. Install wiring only in completed raceway systems and when systems are protected from the weather. Install conductors continuous, without splices are required, make-up slices in boxes; do not use fittings for same. Sufficient lengths shall be left at outlets, boxes, etc., for splicing and connecting to apparatus without straining.

G. Install conductors in such a manner that the bending radius of any wire or cable is not less than the minimum recommended by IPCEA and/or the manufacturer. Do not exceed manufacturer's recommended values for maximum pulling tension applied to any wire or cable.

H. Branch circuit wiring for lighting and receptacle shall be installed in accordance with layout shown on the Drawings and shall be divided and approximately balance about the neutral.
1. Branch circuits shall be grouped and consist of one neutral for each three circuits.
The three hot wires of each four wire circuit shall be distributed across the hot busses in the lighting panel and the white wire connected to the neutral.
2. Phasing for all feeder and branch circuit wiring shall be color coded. Color code system shall be per NEC.

I. UL Type W rope lay cable shall be installed in open cable tray and shall be supported at
6" intervals. Installation shall be in strict accordance with NEC Article 392.

3.03 TESTING

A. After wires and cables are in place and before being connected to device and equipment, the system shall be tested for shorts and grounds.

B. All hot wires, if shorted or grounded, shall be removed and replaced.

C. All meters, cables, connections, equipment, or apparatus necessary for making tests shall be furnished by the Contractor.

D. The Owner will contract, and pay directly, all required additional testing during construction.

3.04 SPLICES AND TERMINATION

A. Splice and terminate conductors with connections and lugs as specified for the specific size and type of conductor. Indent all compression type connectors and lugs with tools as recommended by the connector or lug manufacturer.

B. Thoroughly clean wire ends before connectors or lugs are applied.

C. Insulate all bare surfaces of conductors with a minimum of four (half lap in two directions) of electrical insulating tape. On larger splices and terminals, build up connection with electrical insulating putty before applying tape, to eliminate both sharp edges and voids. The insulating value of the joint or splice must be at least equal to the insulating value of the conductor to which it is applied.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 STANDARDS AND CODES

A. Methods of installation shall comply with the provisions of applicable sections of the 2014 edition of the NEC, the 2014 State of Michigan Electrical Code with Part 8 amendments, the 2015 Michigan Building Code, and the ICC Electrical Code.

B. Materials shall be UL and NEC approved for the application.

1.03 SUMMARY

A. Section includes:
   1. System grounding
      a. Secondary service neutrals shall be grounded at the supply side of the secondary disconnecting means and at the related transformers.
      b. Separately derived systems (transformers downstream from the service entrance) shall have the secondary neutral grounded.
   2. Equipment bonding
      a. All metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames and other conductive items in close proximity with electrical circuits shall be bonded for personnel safety and to provide a low impedance path for possible ground fault currents.

1.04 SUBMITTALS

A. Submit catalog cuts and descriptive literature with sufficient information, clearly presented, to determine compliance with contract documents.

B. Submit certified test reports of ground resistance.

C. Submit, two weeks prior to final inspection, certification that the material and installation is in accordance with the contract documents and has been properly installed.

PART 2 PRODUCTS

2.01 GROUNDING WIRES

A. Grounding wires shall be UL and NEC approved types, copper, insulated and color

identified green, except where indicated otherwise.

B. Wire size shall not be less than that indicated on the drawings and not less than required by the 2014 NEC.

2.02 GROUND RODS

A. Ground rods shall be copperclad steel, 3/4" diameter x 10'-0" long.

2.03 GROUNDING SYSTEM

A. Fixed equipment, lighting and receptacles shall be grounded and bonded with separate green insulated ground conductor sized in accordance with NEC, minimum size #12, run with circuit conductors.

B. Ground system shall be obtained by extending insulated ground conductor throughout the system from the service entrance point. Equipment ground conductors shall be sized in accordance with NEC Table 250.122.

PART 3 EXECUTION

3.01 INSTALLATION

A. Grounding shall be in accordance with 2014 NEC and as indicated in the Contract Documents.

3.02 EQUIPMENT AND CIRCUITS

A. Connect the secondary service neutral to the ground bus in the service equipment.

B. Distributions Panels, Power Panels, and Panelboards.
1. Connect the various feeder green grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
2. Connect the grounding electrode conductors to the ground bus.
3. Connect the neutral to the ground bus (main bonding jumper).
4. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and ground wire to the ground bus.

C. Conduit System
1. Ground all metallic conduit systems
2. Conduit provided for mechanical protection containing only a grounding conductor shall be bonded to that conductor at the entrance and exit from the conduit.

D. Feeders and branch circuits: Install green insulated grounding conductors with all feeders and branch circuits.

E. Boxes, cabinets, enclosures and panelboards
1. Bond the grounding wires to each pullbox, junction box, outlet box, cabinets and other enclosures through which the ground wires pass (except for special

grounding systems for critical systems indicated on the drawings).
2. Provide lugs in each box and enclosure for ground wire termination.
3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs for terminating the ground wires.

F. Motors and starters
1. Provide lugs in motor terminal box and starter housing for ground wire termination.
2. Make ground wire connections to ground bus in power and distribution panels

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions And Division 1 Specification Sections, apply to this section.

1.02 STANDARDS AND CODES

A. Methods of installation shall comply with the provisions of applicable sections of the 2014 edition of the NEC, the 2014 State of Michigan Electrical Code with Part 8 amendments, the 2015 Michigan Building Code, and the ICC Electrical Code.

B. Materials shall be UL and NEC approved for the application.

1.03 DESCRIPTION OF WORK

A. Extent of supports, anchors, sleeves and seals is indicated by drawings and schedules and/or specified in other sections of this specification.

B. Types of supports, anchors, sleeves and seals specified in this section include the following:
   1. Clevis hangers
   2. C-clamps
   3. I-beam clamps
   4. Conduit straps
   5. Round steel rods
   6. Lead expansion anchors
   7. Toggle bolts
   8. Wall and floor seals
   9. Power-driven threaded studs

C. Supports, anchors, sleeves and seals furnished as part of factory-fabricated equipment, are specified as part of that equipment assembly in other sections of this specification..

PART 2 PRODUCTS

2.01 MANUFACTURED SUPPORTING DEVICES

A. General: Provide supporting devices which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is Installer's option.

B. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:
   1. Clevis Hangers: For supporting 2" rigid metal conduit; galvanized steel; with 1/2" dia. hole for round steel rod; approximately 54 pounds per 100 units.
   2. Reducing Couplings: Steel rod reducing coupling, black steel; approximately 16 pounds per 100 units.
   3. C-Clamps: Black malleable iron; rod size; approximately 70 pounds per 100 units.
   4. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2" approximately 52 pounds per 100 units.
   5. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approximately 7 pounds per 100 units.
   6. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit, galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.
   7. Hexagon Nuts: For 1/2" rod size; galvanized steel; approximately 4 pounds per 100 units. Round Steel Rod: Black steel; 5/8" dia.; approximately 67 pounds per 100 feet.
   8. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel; approximately 200 pounds per 100 units.

K. Anchors: Provide anchors of types, sizes and materials indicated, with the following construction features:
   1. Lead Expansion Anchors: 5/8"; approximately 38 pounds per 100 units.
   2. Toggle Bolts: Springhead; 3/16" x 4"; approximately 5 pounds per 100 units.
   3. Power-driven threaded studs: Heat-treated steel, designed specifically for the intended service.
   4. Manufacturers: Subject to compliance with requirements, provide anchors of one of the following:
      a. Abbeon Cal Inc.
      b. Ackerman Johnson Fastening Systems Inc.
      c. Elcen Metal Products Co.
      d. Hilti Manufacturing
      e. Ideal Industries, Inc.
      f. Josyln Mfg and Supply Co.
      g. Rawlplug Co. Inc.
      h. Star Expansion Co.
      i U.S. Expansion Bolt Co.

L. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated; with the following construction features:
   1. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls.
   2. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

M. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser

conduits.
Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

N. U-Channel Strut Systems:
1. Provide U-channel strut system for supporting electrical equipment, 12-gage hot-dip galvanized steel, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with standard green finish, and with the following fittings which mate and match with U-channel:
   a. Fixture hangers
   b. Channel hangers
   c. End caps
   d. Beam clamps
   e. Wiring studs
   f. Thin wall conduit clamps
   g. Rigid conduit clamps
   h. Conduit hangers
   I. U-bolts
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering channel systems which may be incorporated in the work include, but are not limited to, the following:
   a. Allied Tube and Conduit Corp.
   b. B-Line Systems, Inc.
   c. Elcen Metal Products Co.
   d. Greenfield Mfg Co., Inc.

2.02 FABRICATED SUPPORTING DEVICES

A. Pipe Sleeves: Provide pipe sleeves of one of the following:
1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal: 3" and smaller, 20-gage; 4" to 6", 16-gage; over 6", 14-gage.
2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.
4. Plastic-Pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.

B. Sleeve Seals: Provide sleeve seals for piping which penetrates foundation walls below grade, or exterior walls. Calk between sleeve and pipe with non-toxic, UL-classified caulking material to ensure watertight seal.

PART 3 EXECUTION

3.01 INSTALLATION OF SUPPORTING DEVICES

A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and

NEC for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacings indicated and in compliance with NEC requirements.

D. Torque sleeve seal nuts, complying with manufacturer's recommended values. Ensure that sealing grommets expand to form watertight seal.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 STANDARDS AND CODES

A. Methods of installation shall comply with the provisions of applicable sections of the 2014 Edition of the NEC, the 2014 State of Michigan Electrical Code with Part 8 Amendments the 2015 Michigan Building Code, and the ICC Electrical Code.

B. Materials shall be UL and NEC approved for the application.

PART 2 PRODUCTS

2.01 MATERIALS

A. The materials used in the fabrication of the raceway and outlet box systems shall be products of a manufacturer regularly engaged in the manufacturing of the specified material. Where a manufacturer is named for a particular material, the material of other manufacturer shall be acceptable provided the material meets requirements of the Specification.

2.02 CONDUIT

A. Rigid Galvanized Steel Conduit: Full weight, threaded, rigid steel conduit, galvanized inside and out by hot-dip or electro-galvanizing process. Provide thread protective caps and coupling plugs to prevent injury to threads during handling. Use rigid galvanized steel conduit in interior spaces where exposed and subject to physical damage such as vertical and horizontal runs installed within 10 feet of finished floor, and for all conduit applications regardless of size where installed in earth fill or in poured concrete walls, columns, floors or other concrete structures.

B. Flexible Metal Conduit (1/2" min. size, 36" max. length except for light fixture connections which may be up to 72" long): Formed of one continuous length of spirally wound electro-galvanized steel strip. Use for: Final connections to motor operated equipment such as unit heaters, fans, air handling units, pumps and connections to dry type transformer connections from junction boxes to power pole junction boxes, connections from junction boxes to lighting fixtures and for wiring within casework and millwork. The use of "Super Flex" metal conduit is prohibited.

C. Liquid tight Flexible Metal Conduit (1/2" min. size, 36" max. length): Formed of one

continuous length of spirally wound steel strip, with water and oil tight neoprene jacket. Use for final connections to equipment located in wet areas and at all exterior locations.

D. PVC Conduit: Schedule 40, 90.C conduit shall be composed of polyvinyl chloride and shall conform to NEMA Standards. Conduit fittings and cement shall be by the same manufacturer. PVC conduit may be used for installations where buried outside of the building, encased in concrete or below slabs on grade. Rigid conduit shall be used in all areas of high stress.

E. Electrical metallic tubing (EMT) may be used for lighting and receptacle branch circuit wiring, auxiliary systems wiring, and HVAC control wiring concealed above furred ceilings and in partitions within finished areas. EMT may also be used for feeders run through the building where not exposed to physical damage. EMT shall be zinc-coated steel conforming to ANSI "Specification for Electrical Metallic Tubing, Zubing-Coated"; Triangle, Youngstown, or as approved by Architect.

2.03 CONDUIT FITTINGS

A. Rigid Galvanized Steel Conduit Fittings: Threaded, galvanized malleable iron or heavy steel, water and concrete tight. Grounding type nylon insulated bushings for connectors at cabinets, boxes and gutters.

B. Electrical Metallic Tubing Fittings: Set screw type galvanized malleable iron or steel. Connectors with nylon insulated throats at cabinets, boxes and gutters.

C. Flexible Metal Conduit Fittings: Squeeze, screw, or set screw type galvanized malleable iron or steel with nylon insulated throats.

D. Liquid-tight Flexible Conduit Fittings: Galvanized malleable iron or steel with watertight gaskets, "O" ring and retainer, and nylon insulated throats.

E. Conduit Fittings: Exposed conduit fittings shall be conduit type for sharp turns and tees. Minimum radius shall be compatible with the cable to be installed.

2.04 AUXILIARY GUTTERS

A. Construction, sizes and installation of auxiliary gutters shall comply with NEC, Article 374.

2.05 EXPANSION JOINTS

A. Conduits 3" and larger, rigidly secured to building construction on opposite sides of a building expansion joint, shall be provided with expansion and deflection couplings. The couplings shall be installed in accordance with the manufacturer's written instructions.

B. Conduits smaller than 3" shall be provided with junction boxes on both sides of the expansion joint, and connected by 15" of slack flexible conduit. Flexible conduit shall

have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above may be installed.

C. Expansion and deflection couplings shall also be installed where shown on the drawings.

2.06 BOXES AND FITTINGS

A. Outlet Boxes: Provide galvanized flat rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding.

B. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliance option.

C. Device Boxes: Provide galvanized coated flat rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding.

D. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code-compliance option.

E. Rain-tight Outlet Boxes: Provide corrosion-resistant cast-metal raintight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring-hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.

F. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

G. Floor Boxes: Provide cast-iron watertight adjustable floor boxes as indicated, with threaded-conduit-entrance ends, and vertical adjusting rings, gaskets, brushed

aluminum floor plates and flush screw-on covers with ground flange and stainless steel cover screws.

1. Floor Box Accessories: Provide flush type two-pole, three-wire, grounded-pole, 125 volts, 20-amperes, floor-type receptacles with flanges.

H. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

I. Available Manufacturers: Subject to compliance with requirements, manufacturers offering outlet boxes which may be incorporated in the work include, but are not limited to, the following:

1. Adalet-PLM Div, Scott Fetzer Co.
2. Appleton Electric
3. Square D Company.
4. Midland-Ross Corp.
5. OZ/Gedney; General Signal Co.
6. RACO Div; Harvey Hubbell Inc.
7. Thomas & Betts Co.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION

A. In general, horizontal runs of conduit shall be installed in ceiling plenum. Conduit for convenience outlets, wall mounted fixtures and other wall outlets shall be routed overhead and dropped through wall to the outlet. Conduit shall not be installed in concrete floor slabs except where conditions will not permit the conduit to be routed overhead. Where the installation of concealed conduit is not possible due to the existing building's construction, a finished surface mounted raceway "Wiremold" shall be installed. Surface raceway shall be installed perpendicular to and/or parallel to walls and ceilings. Finished surface raceways shall, where possible, be run low on the wall. Where this is not possible due to door openings, mechanical fan coil units, and air conditioning units, the surface raceway shall be installed on the wall at the intersection of the ceiling and wall.

B. Generally, conduit shall be concealed, except in crawl spaces, tunnels, shafts, mechanical equipment rooms, and at connections to surface panels and free standing equipment, and as otherwise noted.

C. Prior to the installation of any finished surface mounted raceway "Wiremold" (or approved equal), the routing shall be reviewed with and approved by the Architect. Failure to gain written approval will cause the Electrical Contractor, at his own expense, to remove and reinstall the finished raceway as directed by the project Architect.

D. Conduit installed above corridor ceilings, in tunnels or chases and exposed shall be

routed in lines parallel to building construction.

E. No conduit shall be installed less than 6" from piping installed by other trades.

F. Certain conduits are permitted to be embedded in structural concrete work. Contractor shall cooperate with other Contractors of their respective trades to effect the following:
1. Reinforcing steel shall be securely anchored in place before installing conduit.
2. No steel reinforcing shall be displaced from plan dimensions without approval of Architect.
3. Conduit shall not be placed over top of reinforcing or under bottom of reinforcing
4. Conduit and fittings shall not displace concrete in columns in excess of 4% of total cross-section area of column without approval of Architect.
5. Conduit shall not be placed closer than three diameters on center.
6. Maximum size of embedded conduit or pipe shall not exceed 1/3 thickness of structural slab; 2/3 thickness of topping slab.

G. Minimum size conduit shall be 1/2" for power, control and lighting and 1" for communications applications. Where specific sizes required by Drawings or Specifications are larger than Code requirements, the larger size shall be provided. (Size conduit for THW wire.)

H. Install the conduit system mechanically and electrically, continuous from outlet to outlet and to cabinets, junction or pull boxes. Conduit shall enter and be secured to cabinets and boxes in such a manner that all parts of the system will have electrical continuity.

I. Rigid galvanized steel metal conduit buried in earth fill shall be coated with an Architect approved corrosion resistant material.

J. In all exterior work, provide rigid galvanized steel conduit work with corrosion resistant coating.

K. Where cable trays are installed for communications cables, conduit shall be installed from the equipment junction box to the cable tray.

L. Communications conduit bends shall be made so that the radius of the curve of the Inner edge is not less than ten times the conduit outside diameter.

M. Install a nylon braided polyester or propylene pull cord with 12" minimum slack at the ends for each empty telephone/data communications conduit.

N. All conduit shall be concealed in all finished areas. All corridors, supply rooms, storage rooms, locker and shower rooms, etc., shall be considered as finished spaces.

3.02 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

A. General: Install electrical boxes and fittings where indicated, in accordance with

manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

C. Outlets installed indoors and outdoors in wet locations shall have an enclosure which is
weatherproof whether or not the attachment cap is inserted.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Install electrical boxes in those locations to ensure ready accessibility to enclosed electrical wiring.

F. Avoid installing boxes back-to-back in walls. Provide not less than 6" (150 mm) separation.

G. Avoid installing aluminum products in concrete.

H. Position recessed outlet boxes accurately to allow for surface finish thickness.

I. Set floor boxes level and flush with finish flooring material.

J. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surfaces.

K. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

L. Provide electrical connections for installed boxes.

M. Subsequent to installation of boxes, protect boxes from construction debris and damage.

3.03 GROUNDING

A. Upon completion of installation work, properly ground electrical boxes and demonstrate
compliance with requirements.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Division-16 Basic Electrical Materials and Methods section apply to work specified in this section.

1.02 STANDARDS AND CODES

A. Methods of installation shall comply with the provisions of applicable sections of the 2014 edition of the NEC, the 2014 State of Michigan Electrical Code with Part 8 amendments, the 2015 Michigan Building Code, and the ICC Electrical Code.

B. Materials shall be UL and NEC approved for the application.

C. UL Compliance: Comply with applicable requirements of UL Std 969, "Marking and Labeling Systems", pertaining to electrical identification systems.

D. ANSI Compliance: Comply with applicable requirements of ANSI Std A13.1, "Scheme For the Identification of Piping Systems".

E. NEMA Compliance: Comply with applicable requirements of NEMA Std No's. WC-1 and WC-2 pertaining to identification of power and control conductors.

1.03 DESCRIPTION OF WORK

A. Types of electrical identification work specified in this section include the following:
1. Buried cable warnings.
2. Electrical power, control and communication conductors.
3. Operational instructions and warnings.
4. Danger signs.
5. Equipment/system identification signs.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical identification materials and products.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electrical identification products which may be incorporated in the work

include, but not limited to, the following:

1. Brady, W.H. Co.
2. Calpico Inc..
3. Direct Safety Co.
4. George-Ingraham Corp.
5. Ideal Industries, Inc.

2.02 ELECTRICAL IDENTIFICATION MATERIALS

A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

B. Color-Coded Conduit Markers:

1. General: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, plastic-sheet conduit markers, extending 360 degrees around conduits; designed for attachment to conduit by adhesive, adhesive lap joint of marker, matching adhesive plastic tape at each end of marker, or pre-tensioned snap-on. Except as otherwise indicated, provide lettering which indicates voltage of conductor(s) in conduit. Provide 8" minimum length for 2" and smaller conduit, 12" length for larger conduit.
2. Colors: Unless otherwise indicated or required by governing regulations, provide white markers with black letters.
3. Color-Coded Plastic Tape:
   a. General: Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick by l-l/2" wide.
   b. Colors: Unless otherwise indicated or required by governing regulations, provide orange tape.
4. Underground-Type Plastic Line Marker:
   a. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried cable.
5. Cable/Conductor Identification Bands:
   a. General: Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type; either pre-numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.
6. Plasticized Tags:
   a. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention and operational tags, of plasticized card stock with matt finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary working, e.g., DANGER, CAUTION, DO NOT OPERATE.
7. Self-Adhesive Plastic Signs:
   a. General: Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application, e.g., 208V, EXHAUST FAN, RECTIFIER.

b. Colors: Unless otherwise indicated, or required by governing regulations, provide white signs with black lettering.

8. Baked Enamel Danger Signs:
   a. General: Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20-gage steel; of standard red, black and white graphics; 14" x 10" size except where 10" x 7" is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH.
9. Engraved Plastic-Laminate Signs:
   a. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, black face and white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
   b. Thickness: 1/16", for units up to 20 sq. in or 8" length; 1/8" for larger units.
   c. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.03 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART 3 EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:
1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NEC.
2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit Identification:
1. General: Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by a color-coded method, apply color-coded identification on electrical conduit in manner similar to piping identification. Except as otherwise indicated, use white as coded color for conduit.

C. Underground Cable Identification:
1. General: During back-filling/top-soiling of each exterior underground electrical, signal or communication cable, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where

multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.
2. Limit use of line markers to direct-burial cables.
3. Install line marker for every buried cable, regardless of whether direct-buried or protected in conduit.

D.. Cable/Conductor Identification:
1. General: Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.

E. Operational Identification and Warnings:
1. General: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

F. Danger Signs:
1. General: In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.
2. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.
3. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.

G. Equipment/System Identification:
1. General: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/ control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, □" high lettering on 1-1/2" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:
   a. Panelboards, electrical cabinets and enclosures.
   b. Access panel/doors to electrical facilities.
   c. Major electrical switchgear.

d. Automatic transfer equipment.
e. Fire alarm master station.

2. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate the substrate.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02 STANDARDS AND CODES

A. Methods of installation shall comply with the provisions of applicable sections of the 2014 edition of the NEC, the 2014 State of Michigan Electrical Code with Part 8 amendments, the 2015 Michigan Building Code, and the ICC Electrical Code.

B. Materials shall be UL and NEC approved for the application.

C. Requirement of ANSI/ASHRAE/IES Standard 90.1 – 2013, Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.03 MICHIGAN UNIFORM ENERGY CODE COMPLIANCE

A. DRAWINGS: Within 30 days after the date of system acceptance, the electrical contractor shall submit record drawings of the actual electrical installation to the building owner, including:
   1. A single line diagram of the building electrical distribution system and;
   2. Floor plans indicating location and area served for all distribution.

B. MANUALS: An operating and maintenance manual shall be provided to the building owner. The manuals shall include, at a minimum, the following:
   1. Submittal Data stating equipment rating and selected options for each piece of Equipment requiring maintenance.
   2. Operation manuals and maintenance manuals for each piece of equipment requiring maintenance required routine maintenance actions shall be clearly identified.
   3. Names and address of at least one qualified service agency.
   4. A complete narrative of how each system is intended to operate.

1.04 SUMMARY

A. Extent of lighting control system work is indicated by drawings and by the requirements of this section. It is the intent of this section to provide an integrated energy saving, lighting control system including occupancy sensors, power packs, wall controls, etc. from a single supplier.

B. Manufacturers: Firms regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.05 SUBMITTALS

A. Submit manufacturer's data on lighting control system and components including Shop drawings, detailed point to point wiring diagrams, and floor plans showing occupancy and daylighting sensor locations. Provide typical mounting details for occupancy and daylighting sensors for this application.

1.06 MANUFACTURERS

A. Subject to compliance with requirements, provide lighting controls of one of the following manufacturers:
   1. Acuity Controls
   2. Watt Stopper
   3. Leviton
   4. Greengate
   5. Lutron

B. Prior approval does not guarantee final approval by the electrical engineer. The contractor shall be completely responsible for providing a system meeting this specification in its entirety. All deviations from this specification must be listed and individually signed off by the consultant.

PART 2 PRODUCTS

2.01. OCCUPANCY SENSORS AND POWER PACKS

A. Occupancy Sensors:
   1. Passive infrared sensors shall:
      a. Utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.
      b. Provide high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line).
      c. Have a multiple segmented Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.
   2. Dual technology sensors shall:
      a. Be either corner mounted or ceiling mounted in such a way as to minimize coverage in unwanted areas.
      b. Use passive infrared and ultrasonic technologies for occupancy detection products that react to noise or ambient sound shall not be considered.
   3. Ultrasonic sensors shall:
      a. Utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and airflow throughout controlled space.
      b. Have and ultrasonic operating frequency that is crystal controlled at 25 kHz within 0.005% tolerance, 32 kHz within 0.002% tolerance,or 40 kHz within 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable
   4. General Requirements:
      a. All sensors shall be capable of operating normally with Light Emitting Diode drivers.

b. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
c. Where specified, sensors shall utilize technology for automatically adjustable time delay and sensitivity settings.
d. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
e. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
f. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
g. Where specified, sensor shall have an internal additional isolated relay with Normally Open,/ Normally Closed and Common outputs for use with HVAC Control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

B. Relay Modules – Power Packs:
1. For ease of mounting, installation and future service, the relay module – power pack unit(s) shall be able to externally mount through a 1/2" knock-out on standard electrical outlet box or enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low -voltage power control unit shall provide power to a minimum of two (2) sensors.
2. For applications where dimming is required, the relay module shall include a 0-10V dimming output.
3. Relay Contacts shall have ratings of:
   a. 13A - 120 VAC Tungsten
   b. 20A - 120 VAC Ballast
   c. 20A - 277 VAC Ballast
4. Control wiring between sensors and relay module – power pack units shall be Class II, 18-20 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

a. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

C. Photocell Sensors:
1. Each photo sensor shall be mounted in the appropriate location for measuring the available daylight. Each sensor shall have a control/calibration module. Settings shall be located on the sensor and shall be recessed to limit tampering.

D Manual Lighting Control Stations:
1. Manual control lighting control stations shall provide On/Off, or On/Off & Raise/Lower lighting control.
   a. Lighting control stations shall mount in a single gang wall outlet box or low-voltage ring.
   b. Control stations shall enable local control of a lighting zone.

c. Control stations shall provide 0-10V low-voltage dimming output.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install lighting control system components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices. Comply with requirements of National Electrical Code, and applicable portions of NECA's "Standard of Installation" pertaining to general electrical installation practices.

B. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work.

C. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B.

3.02 GROUNDING

A. Provide equipment grounding connections for lighting control equipment as indicated. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.03 PROGRAMMING

A. Manufacturer shall provide system programming of all components for the lighting control systems.

3.04 SYSTEMS START UP

A. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all system components. The Startup requirement is intended to verify that the lighting controls interact as a complete and operational system to meet the design intent.

B. Manufacturer to provide a written statement verifying that the system meets the design intent.

C. Training: Manufacturer shall provide factory authorized application engineer to train Owner personnel in the operation, programming and maintenance of the lighting control systems including the proper care and adjustment of all occupancy sensor types and controls.

D. Documentation
1. Manufacturer shall provide system documentation including:
a. Reflected ceiling plans showing each occupancy and daylighting sensor and manual control station locations.

b. Typical wiring diagrams for each component.
c. The manufacturer will certify that the products will meet the product specifications and Michigan Energy Code. If any additional equipment is required to meet the required coverage patterns, the manufacturer shall provide the additional equipment at no cost to the owner.

3.05 TESTING

A. Test capability of lighting system, after installation work is complete, to demonstrate Compliance with requirements. Where possible, correct mal-functioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

B. Instruct Owner's building personnel in procedures for starting-up, testing, maintaining and operating lighting control system equipment, including both the system's software and hardware.

3.06 EXTENDED WARRANTY

A. Manufacturer shall provide a 4 year extended warranty in addition to a required one-year warranty for all system components.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions +and Division 1 Specification sections, apply to work of this section.

1.02 STANDARDS AND CODES

A. Methods of installation shall comply with the provisions of applicable sections of the 2014 edition of the NEC, the 2014 State of Michigan Electrical Code with Part 8 amendments, the 2015 Michigan Building Code, and the ICC Electrical Code.

B. Materials shall be UL and NEC approved for the application.

1.03 SUBMITTALS

A. Submit catalog cuts and data for switches and receptacles necessary to evaluate the proposed devices

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Quality Assurance:
1. Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three years.
2. Installer Qualifications: Firm with at least 5 years of successful installation experience on projects utilizing wiring devices similar to those required for this project.
3. NEC Compliance: Comply with 2014 NEC as applicable to installation and wiring of electrical wiring devices.
4. UL Compliance: Comply with applicable requirements UL20, 486A, 498, and 943 pertaining to installation of wiring devices.
5. Provide wiring devices which are UL-listed and labeled.
6. IEEE Compliance: Comply with applicable requirements of IEEE Std 241, "Recommended Practice for Electric Power Systems in Commercial Buildings", pertaining to electrical wiring systems.
7. NEMA Compliance: Comply with applicable portions of NEMA Stds Pub/No. WD 1, "General-Purpose Wiring Devices", WD 2, "Semiconductor Dimmers for Incandescent Lamps" and WD 5, "Specific-Purpose Wiring Devices".

B. Submittals:
1. Product Data: Submit manufacturer's data on electrical wiring devices.

C. Acceptable Manufacturers:
1. Manufacturers: Subject to compliance with requirements, provide wiring devices

of one of the following (for each type and rating of wiring device):

a. Arrow-Hart Div, Crouse-Hinds Co.
b. Leviton
c. Harvey Hubbell Inc.
d. Pass and Seymour Inc.
e. Sierra

2.02 GENERAL

A. All wiring devices shall be "Specification Grade".

2.03 SWITCHES

A. Wall switches shall be as follows:
1. Snap: Provide general-duty flush single-pole toggle switches, 20-amperes, 120/277 volts AC, with mounting yoke insulated from mechanism, equip with Plaster ears, switch handles, and side-wired screw terminals.
2. Duplex Snap: Provide general-duty duplex flush 3-way AC quiet switches, 20-amperes, 120/277 volts, with mounting yoke insulated from mechanism, equip with plaster ears, switch handles, and side-wired screw terminals, with break-off tab features, which permits wiring for separate or common feed.
3. Three-way: Provide general-duty duplex flush 3-way AC switches, 20-amperes, 120/277 volts, with mounting yoke insulated from mechanism, equip with plaster ears, lock type switch handles, and side-wired screw terminals, with break-off tab features, which permits wiring for separate or common feed.
4. Four-way: Provide general-duty flush 4-way AC quiet switches, 20-amperes, 120/277 volts, with mounting yoke insulated from mechanism, equip with plaster ears, switch handles, and side-wired screw terminals, with break-off tab features, which permits wiring for separate or common feed.
5. Color to be as selected by Architect.

2.04 RECEPTACLES

A. General-Duty Duplex: Provide duplex specification grade receptacles, 2-pole, 3-wire, grounding, with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke, 20-amperes, 125-volts, with metal plaster ears; design for side and back wiring with NEMA configuration 5-20R, ivory color, unless otherwise indicated.

B. General-Duty Simplex: Provide single specification grade receptacles, 2-pole, 3-wire,
grounding, with green hexagonal equipment ground screw, 20-amperes, 125 volts, with metal plaster ears; design for side and back wiring with NEMA configuration 5-20.

C. Ground-Fault Interrupter Receptacles: Provide "feed-thru" type ground-fault circuit interrupters, with heavy-duty duplex receptacles, capable of protecting connected downstream receptacles on single circuit, and of being installed in a 2-3/4" deep outlet
box without adapter, grounding type UL-rated Class A, Group 1, rated 20-amperes, 120-volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 miliampere ground-fault trip level; equip with NEMA configuration 5-20R

D. Color of devices to be verified with Architect.

2.05 COVER PLATES

A. Cover plates shall be Type 302 stainless steel, .032" nominal thickness, satin finish.
B. Replace all covers on existing receptacles, switches, data/telephone outlets and unused outlets within the area of renovation with new cover plates as specified in A. above.

C. Provide plates for all new lighting controls, switches, receptacles, and other outlets.

PART 3 EXECUTION

3.01 INSTALLATION

A. Switches and receptacles shall be installed and located as follows:
   1. Switches:: See electrical plans.
   2. Receptacles: See electrical plans.

B. In masonry walls, switches and receptacle heights shall be adjusted as required so outlets are at nearest mortar joint to indicated height.

C. Where light switches are located adjacent to doors, they shall be installed on "knob" side of door, unless indicated otherwise.

D. Where walls have wainscot finish, switch height shall be adjusted as required, so switch is either all in wainscot or all in wall above wainscot.

E. Prior to roughing-in outlet boxes, verify door swings, type of wall finishes and locations for counters.

END OF SECTION

SECTION 26 51 00

LIGHTING FIXTURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Section 26 0500 "Common Work Results for Electrical" apply to work specified in this section.

1.02 WORK OF THIS SECTION

A. Interior Lighting Systems.

1.03 STANDARDS AND CODES

A. Methods of installation shall comply with the provisions of applicable sections of the 2014 edition of the NEC, the 2014 State of Michigan Electrical Code with Part 8 amendments,the 2015 Michigan Building Code, and the ICC Electrical Code.

B. Materials shall be UL and NEC approved for the application.

1.04 SUBMITTALS

A. Submit catalog cuts indicating complete description of fixtures to include manufacturing Details photometric curves and method of installation.

B. Submit samples of lighting fixtures upon request.

C. Any equipment proposed as equal to that specified shall be so proven by the Contractor who shall,prior to bidding, submit the manufacturer's name, model numbers, verification data sheets, IES Format photometric data, and applicable installation drawings. The Engineer shall review and approve or disapprove such proposed substitutions prior to bidding.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Lighting fixtures shall be equivalent to those scheduled on drawings.

2.02 LIGHT EMITTING DIODE FIXTURES

A. Light Emitting Diode (LED) lamps and fixtures: All LED light engines (combinations of diodes, driver, heat sink, housing and optics), whether screw-in or hardwired, shall

meet all of the following criteria:

1. The rated driver input wattage and total number of LEDs shall be published by the manufacturer for each scheduled fixture unit (driver and LED combination) and shall be the same wattage used in the fixture listed in the Light Fixture Schedule.
2. LED lamps and fixtures shall carry a safety certification by an approved testing laboratory (UL, CE, ETL, etc.).
3. LED lamps and fixtures shall be approved and listed under either Energy Star or Design Lights Consortium.
4. LED luminaires shall be tested in accordance with the approved industry Measurement standard, IESNA LM-79, the “Approved Method for the Electrical and Photometric Measurements of Solid State Lighting Products”; and IESNA LM-80 “Measuring Lumen Maintenance of LED Light Sources”.
5. Color stability shall be warranted to maintain color properties of no more than a color shift of 200K over a 5 year period.
6. Color Rendering Index (CRI) of LED lamps shall be 80 or above.
7. Lamp Life shall exceed 50,000 hours.
8. Shall be dimmable down to 5% unless otherwise noted.

B. Light fixtures shall be installed in accordance with manufacturer's recommendations.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fixtures as indicated, verifying location from the reflected ceiling plans.

B. Recessed fixtures in removable ceilings shall be connected to the branch circuit with flexible conduit and branch circuit wire from an accessible junction box. Where fluorescent fixture housings are connected together, use 90^{o}C. wire for branch circuit feed through fixture channels.

C. Fixtures shall be grounded. Lamp sockets shall be wired so that the outer shell is connected to the neutral, grounded conductor.

D. Fixtures recessed in furred ceilings or in soffits shall be installed so that they can be removed from below the ceiling.

E. Fixtures installed in acoustical tile shall not be supported directly from the ceiling finish material. Support fixtures from metal bar hangers or UNISTRUT channels attached to the ceiling supports.

F. Fixture locations in mechanical rooms shall be coordinated with the mechanical equipment layout.

G. Exposed open fixtures shall be protected with wire guards.

H. All recessed fluorescent fixtures installed in GRID ceiling shall be securely fastened to the GRID ceiling by earthquake or caddy clips.

3.02 FIELD QUALITY CONTROL

A. Inspect installed units for damage.

B. Provide instruments to make and record test results.

C. Tests: Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source. The following tests shall be required:
   1. Check for uniformity of illuminations.
   2. Replace or repair damaged and malfunctioning units and retest.

3.03 ADJUSTING AND CLEANING

A. Clean components on completion of installation. Use methods and materials recommended by manufacturer.

B. Adjust wall wash fixtures to provide required light distribution and optimum intensities.

END OF SECTION

SECTION 27 05 28

DATA/ TELEPHONE CONDUIT SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 STANDARDS AND CODES

A. Methods of installation shall comply with the provisions of applicable sections of the 2014 edition of the NEC, the 2014 State of Michigan Electrical Code with Part 8 amendments, the 2015 Michigan Building Code, and the ICC Electrical Code.

B. Materials shall be UL and NEC approved for the application.

1.03 DESCRIPTION OF WORK

A. Extent of data/ support/ telecommunications system work is indicated by drawings and diagrams.

B. General:

1. The Electrical Contractor shall be responsible for all labor, material and installation of all raceways, backboards, cabinets, outlet boxes, cover plates and miscellaneous hardware necessary to complete the installation of the data/ telephone conduit system.

1.04 SUBMITTALS

A. Submit proposed method of marking/labeling of conduits and outlet boxes for approval before any permanent labeling is begun.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Data/ telephone conduit system shall meet same basic requirements as Section 26 0000.

B. Wall telephone/data outlets shall be 4-1/16" square outlet boxes with double gang raised cover and 2-gang telephone/data style plates.

C. Floor telephone outlets shall be as per Section 26 05 33.

D. Backboards and terminal boards shall be 3/4" thick fire retardant plywood.

PART 3 EXECUTION

3.01 INSTALLATION

A. Consult with data/ telephone system supplier prior to installing the service and conduit system and verify the exact requirements before proceeding with the work.

B. Outlet Mounting Heights:
   1. Install wall telephone outlets at same height as convenience outlets in same room.
   2. Install outlets for wall mounted telephones at elevation above finished floor indicated on plans, and at 48" above finished floor for handicapped public telephones.

C. Minimum size telephone/data conduit shall be 1".

D. All conduits shall be run concealed in walls.

E. Terminate all conduits serving individual outlets +4" above accessible finished ceiling.

F. Install nylon pull string in all data/ support/ telecommunications conduits leaving 12" leads at each end for use by Owner's systems installation contractor.

END OF SECTION

APPENDIX A

PHOTO REPORT – WATER TREATMENT

Admin Building – AD-1

Overview of the roof area.

Admin Building – AD-1

Overview of the roof area.

Admin Building – AD-1

Overview of the roof area.

Admin Building – AD-1

Overview of the roof area.

Admin Building – AD-1

Overview of the roof area.

Admin Building – AD-1

Overview of the roof area.

Admin Building – AD-1

Shaling of ballast creating sharp objects that can penetrate the roof system.

Admin Building – AD-1

Ponding water noted due to lack of slope at wall.

Admin Building – AD-1

Missing fasteners at ladder. Install appropriate fasteners to avoid holes in flashing due to ladder movement.

Admin Building – AD-1

Hole in flashing transition. Install appropriate flashing patch.

Admin Building – AD-1

Low flashing boot at penetration. Needs to be raised to 8” from roof surface or install new flashing boot.

Admin Building – AD-1

Deteriorated penetration filler at pipe. Recommend installing new penetration filler with rain collar watershed.

Admin Building – AD-1

Deteriorated sealant at EPDM patch in between copings. Additional sheet metal flashing is required.

Admin Building – AD-1

Small holes in flashing likely from dragging equipment near wall. Provide appropriate flashing patch.

Admin Building – AD-3

Overview of the roof area.

Admin Building – AD-3

Overview of the roof area.

Admin Building – AD-3

Minor deterioration of flashing. Monitor to prevent failure of flashing.

Admin Building – AD-3

Blisters and mineral granule loss on roof surface. Monitor to see if condition worsens.

Admin Building – AD-3

Note masonry cracking at corner of parapet wall transition. Additional evaluation of masonry recommended.

Admin Building – AD-2

Overview of roof area above building entry.

Admin Building – AD-2

Overview of the roof area.

Admin Building – AD-2

Overview of the roof area.

Admin Building – AD-2

Overview of the roof area.

Admin Building – AD-2

Signs of leakage at lintel below roof system. Additional evaluation of masonry recommended.

Control Rooms – CR-1

Overview of the roof area.

Control Rooms – CR-1

Overview of the roof area.

Control Rooms – CR-1

Overview of the roof area.

Control Rooms – CR-1

Vegetative growth on roof surface. Note masonry wall mortar deterioration.

Control Rooms – CR-1

Concrete coping loose and mortar deteriorated. Immediate corrective action is recommended.

Control Rooms – CR-1

Deteriorated mortar at concrete coping. Additional evaluation needed.

Control Rooms – CR-1

Deteriorated sealant at termination bar. Unsealed termination bar can allow for water infiltration. Note area of exposed masonry between coping flashing and termination bar, this area can allow for moisture ingress and should be covered.

Control Rooms – CR-1

Deteriorated sealant at termination bar. Unsealed termination bar can allow for water infiltration.

Control Rooms – CR-1

Deteriorated mortar at base of coping and at corner transition. Additional evaluation recommended.

Control Rooms – CR-1

Flaking of brick masonry due to moisture infiltration. Additional evaluation recommended.

Control Rooms – CR-1

Flaking of brick masonry due to moisture infiltration indicative of inadequate flashing system below coping stones. Additional evaluation recommended.

Control Rooms – CR-1

Overview of fiberglass skylight panels.

Control Rooms – CR-1

Deteriorated/missing gasket at skylight fasteners. Replace with new fasteners and gaskets to prevent potential for water infiltration.

Control Rooms – CR-1

Overview of rooftop concrete pad.

Control Rooms – CR-1

Minor deterioration of sealant at termination bar. Monitor condition to see if it worsens.

Control Rooms – CR-1

Rust at brick lintel and signs of moisture infiltration. Additional evaluation of masonry wall recommended.

Control Rooms – CR-1

Wrinkles at base flashing, related to shrinkage of roof system and no perimeter securement using fasteners. Note vegetation growth on roof surface.

Control Rooms – CR-1

Displaced aggregate and vegetation growth on roof surface.

Control Rooms – CR-2

Overview of the roof area.

Control Rooms – CR-2

Overview of the roof area.

Control Rooms – CR-2

Overview of the roof area.

Control Rooms – CR-2

Overview of the roof area.

Control Rooms – CR-2

Vegetation growth on roof surface. Remove vegetation to prevent any potential root penetration in roof surface.

Control Rooms – CR-2

Overview of metal closure piece. Note lifting of metal, needs to be re-secured/sealed.

Control Rooms – CR-2

Exposed termination bar at wall. This condition relies on sealant to prevent water intrusion. The correct design should include a counterflashing over the termination bar.

Control Rooms – CR-2

Cracked masonry noted. Additional evaluation recommended.

Control Rooms – CR-2

Ladder not fixed to the wall and support is working it's way through the base flashing. Secure ladder through wall to prevent movement.

Control Rooms – CR-2

Vegetation growth on roof surface. Recommend removal of vegetation.

WHS Building – WHS-1

Overview of the roof area.

WHS Building – WHS-1

Overview of the roof area.

WHS Building – WHS-1

Overview of the roof area.

WHS Building – WHS-1

Overview of the roof area.

WHS Building – WHS-1

Overview of flashing at perimeter concrete coping. Monitor unsecure termination of counterflashing for future issues. Note the flashing has a negative slope and seam integrity is suspect.

WHS Building – WHS-1

Overview of penetration flashing. No issues noted.

WHS Building – WHS-1

Overview of power ventilator flashing. No issues noted.

WHS Building – WHS-1

Overview of roof surface. Minor ponding noted.

WHS Building – WHS-1

Open flashing at pipe penetration. Recommend resealing flashing, consider contractor guarantee claim since the lap sealant is missing and detail is not adequate.

WHS Building – WHS-1

Overview of coping flashing tie-in. Monitor to ensure flashing does not fail. Additional metal is necessary as this is an unreliable detail.

WHS Building – WHS-1

Overview of ladder assembly.

WHS Building – WHS-1

Overview of manufacturer's stamp. 90mil EPDM and likely installed in 2016.

Filter Gallery – F-5

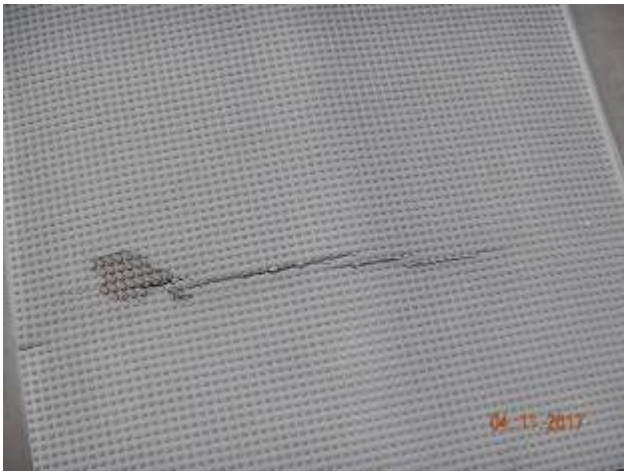
Overview of the roof area.

Filter Gallery – F-5

Cracks at brick masonry. Note exposed termination bar. If the sealant fails water can infiltrate, it is better design to install a counterflashing over termination bars. Note masonry flashing/weep system not evident if/how masonry drains is unknown.

Filter Gallery – F-5

Membrane adhesive deteriorated likely due to age. System is at end of its service life.



Filter Gallery – F-5

Cracked walkway pad due to system deterioration.

Filter Gallery – F-5

Deteriorated flashing adhesion. Roof system should be replaced.

Filter Gallery – F-5

Walkway pad adhesive failing.

Filter Gallery – F-5

Flashing seam reinforcing starting to show due to overall deterioration.

Filter Gallery – F-5

Exposed termination bar at roof system transition. Inadequate detailing.

Filter Gallery – F-5

Sealant deterioration at expansion joint termination bar.

Filter Gallery – F-2

Overview of the roof area.

Filter Gallery – F-2

Overview of the roof area.

Filter Gallery – F-2

Fastener backed out through perimeter edge flashing. Hole will need to be patched to limit moisture ingress until time of replacement.

Filter Gallery – F-2

Deficient adhesion at membrane seams. Recommend roof replacement due failure of seams.

Filter Gallery – F-2

Deficient adhesion to membrane field patch. Signs of previous system issues.

Filter Gallery – F-2

Deficient adhesion of roof walkpads.

Filter Gallery – F-2

Overview of the roof area.

Filter Gallery – F-2

Deficient adhesion of perimeter edge patches. Recommend replacement of roof system.

Filter Gallery – F-2

Deficient adhesion of field patches on roof membrane. Signs of deficient adhesive of glued seams is related to older EPDM system with outdated seaming technology.

Filter Gallery – F-3

Overview of the roof area.

Filter Gallery – F-3

Shaling of ballast rocks which creates shards that can penetrate roof surface.

Filter Gallery – F-3

Diagonal wrinkles at base flashing corner. Signs of shrinkage of EPDM membrane and inadequate securement at transition. Recommend replacement as the system is experiencing failure.

Filter Gallery – F-3

Shrinkage of base flashing of EPDM system. Recommend replacement as the system is experiencing failure.

Filter Gallery – F-3

Manufacturer's stamp is 1989 by Firestone.

Filter Gallery – F-3

Loose counterflashing.

Filter Gallery – F-3

Overview of ladders. Recommend replacing at time of roof replacement as there is significant rust present.

Filter Gallery – F-3

Cracks at concrete masonry termination at brick. Additional evaluation recommended.

Filter Gallery – F-3

Overview of roof level clerestory windows. Monitor sealant to prevent leakage or failure of seal. Additional evaluation/water testing recommended to evaluate system.

Filter Gallery – F-3

Deteriorated of glazing sealant noted at clerestory windows.

Filter Gallery – F-3

Gasket failure at clerestory window.

Filter Gallery – F-3

Cracks at concrete wall adjacent to clerestory windows.

Filter Gallery – F-3

Open flashing seam. Recommend re-sealing to minimize water infiltration until roof replacement.

Filter Gallery – F-3

Major base flashing shrinkage noted. Recommend roof replacement.

Filter Gallery – F-4

Overview of the roof area.

Filter Gallery – F-4

Diagonal wrinkles at base flashing. Thermal shrinkage of roof system noted.

Filter Gallery – F-4

Deteriorated mortar at concrete coping stones. Additional evaluation recommended.

Filter Gallery – F-4

Exposed reinforcing at concrete wall. Additional evaluation recommended.

Filter Gallery – F-4

Major base flashing shrinkage noted. Recommend roof replacement.

Filter Gallery – F-4

Hole in base flashing. Will likely propagate into larger tear during thermal cycle.

Filter Gallery – F-4

Major base flashing shrinkage noted. Recommend roof replacement.

Filter Gallery – F-4

Exposed termination bar at expansion joint. Note deteriorated sealant at termination bar.

Filter Gallery – F-4

Shaling of brick masonry. Signs of water infiltration within masonry wall. Additional evaluation recommended.

Filter Gallery – F-4

Vegetation growth on roof surface.

Filter Gallery – F-4

Rust at counterflashing. Signs of water within the wall system.

Filter Gallery – F-4

Overview of roof level clerestory windows.

Filter Gallery – F-4

Caulking over clerestory windows. Signs of previous issues at window system. Additional evaluation recommended.

Filter Gallery – F-4

Shaling of ballast rocks which creates shards that can penetrate roof surface.

Filter Gallery – F-7

Overview of the roof area. Note vegetation growth on roof surface.

Filter Gallery – F-7

Shaling of brick masonry. Signs of water within masonry wall. Additional evaluation recommended.

Filter Gallery – F-7

Exposed termination bar. If the sealant fails water can infiltrate, it is better design to install a counterflashing over termination bars.

Filter Gallery – F-7

Deteriorated mortar and brick at masonry transition. Additional evaluation recommended as it the wall system appears to have issues with moisture infiltration leading to continued degradation of masonry and roof system.

Filter Gallery – F-7

Open base flashing at base of masonry wall. Hole needs to be patched to limit moisture infiltration.

Filter Gallery – F-7

Rust at roof vent penetration.

Filter Gallery – F-7

Overview of roof level clerestory windows.

Filter Gallery – F-7

Failed gasket at clerestory window. Near areas of reported leakage. Additional evaluation recommended to determine corrective action.

Filter Gallery – F-7

Deteriorated sealant at window frame terminations. Additional evaluation recommended to determine corrective action.

Filter Gallery – F-7

Open flashing at roof expansion joint above clerestory windows. Roofing replacement will correct this condition.

Filter Gallery – F-1

Overview of the roof area.

Filter Gallery – F-1

Overview of the roof area.

Filter Gallery – F-1

Corrosion at vent wall penetration. Anti-corrosive treatment recommended.

Filter Gallery – F-1

Open masonry joint at concrete and brick termination. Re-seal with appropriate masonry sealant.

Filter Gallery – F-1

Exposed termination bar at concrete wall.

Filter Gallery – F-1

Vegetation growth on roof surface.

Filter Gallery – F-1

Mortar failure at concrete coping joint. Additional evaluation recommended for masonry repairs.

Filter Gallery – F-1

Vertical cracking through brick masonry. Likely moisture within wall. Additional evaluation recommended for masonry repairs in conjunction with any future roof replacement.

Filter Gallery – F-1

Open base flashing joint and termination bar failure. Water infiltration likely within system.

Filter Gallery – F-1

Base flashing shrinkage at concrete wall. Signs of thermal shrinkage of roof system relating to end of roof system life.

Filter Gallery – F-1

Base flashing shrinkage noted. Thermal shrinkage is related to end of service life for the roof system.

Filter Gallery – F-1

Rust noted at steel lintel at base of masonry coping.

Filter Gallery

Overview of underside of roof system.

Filter Gallery

Overview of concrete deck panels.

Filter Gallery

Cracking at concrete deck transition.

Filter Gallery

Rust noted at HVAC system.

Filter Gallery

Cracking on wall at base of clerestory window.

Filter Gallery

Water stains noted at clerestory windows. Obvious signs of leakage. Additional evaluation recommended to determine corrective action.

Filter Gallery

Rust at corner of clerestory window frame. Signs of water infiltration.

Filter Gallery

Coating at concrete peeling. Signs of water infiltration.

Rapid Mix Building – R-1

Overview of the roof area.

Rapid Mix Building – R-1

Overview of the roof area.

Rapid Mix Building – R-1

Shaling of ballast rocks which creates shards that can penetrate roof surface when subjected to roof top traffic.

Rapid Mix Building – R-1

Open base flashing at corner. Note exposed termination bar. Counterflashing should be installed and flashing sealed.

Rapid Mix Building – R-1

Split at perimeter strip-in at flange. Patch strip-in to prevent water infiltration.

Rapid Mix Building – R-1

Deficient adhesion at flashing strip-in. Strip-in should be replaced due to defects.

Rapid Mix Building – R-1

Dent at metal fascia likely from a lift or type of equipment.

Rapid Mix Building – R-1

Open flashing at metal flange termination. Patch/re-seal corner to prevent water infiltration.

Carbon House – CH-1

Overview of the roof area.

Carbon House – CH-1

Overview of the roof area.

Carbon House – CH-1

Base flashing pulling from wall showing old age of roofing system.

Carbon House – CH-1

Deteriorated sealant at base of stone coping.

Carbon House – CH-1

Flaking of brick masonry indicating signs of moisture infiltration.

Carbon House – CH-1

Deterioration of mortar at brick masonry wall.

Carbon House – CH-2

Overview of the roof area.

Carbon House – CH-2

Minor surface erosion throughout.

Filter Press – FP-1

Overview of the roof area.

Filter Press – FP-1

Overview of the roof area.

Filter Press – FP-1

Deteriorated sealant at clamping ring and flashing boot.

Filter Press – FP-1

Deteriorated sealant at metal coping seam.

Filter Press – FP-1

Rust at roof top unit curbs.

Filter Press – FP-1

Exposed/rusted fasteners at wall panel.

Filter Press – FP-1

Deteriorated sealant at top of counterflashing.

Filter Press – FP-1

Temporary flashing membrane cover over obsolete curb. Recommend installing a permanent metal cover or removing and decking over.

Filter Press – FP-1

Open flashing detail patch and can allow for moisture infiltration.

Filter Press – FP-1

Interior photo of underside of metal decking.

Calciner Building – CA-1

Overview of the roof area.

Calciner Building – CA-1

Overview of the roof area.

Calciner Building – CA-1

Debris on roofing surface.

Calciner Building – CA-1

Deteriorated sealant at metal coping seam.

Calciner Building – CA-1

Rust and paint failure at conduit pipe supports.

Calciner Building – CA-2

Overview of the roof area.

Penthouse – P-1

Overview of the roof area.

Penthouse – P-1

Overview of the roof area.

Penthouse – P-1

Missing/loose walkpads preventing foot traffic protection.

Penthouse – P-1

Deteriorated sealant at pipe boot and clamping ring. Note rusted pipe projection.

Penthouse – P-1

Deteriorated sealant at termination bar potentially allowing moisture infiltration.

Penthouse – P-1

Gasket failure at penthouse windows.

Penthouse – P-1

Stretching of pipe boots at pipe projections and sealant deterioration.

Penthouse – P-1

Flaking/deterioration of brick masonry wall showing signs of moisture infiltration suspected cause being the stone coping/flashing. Note previous masonry wall repairs/patches.

Penthouse – P-1

Core cut through roof system revealing water within system.

Penthouse

Interior view of underside of decking and masonry wall cracking.

Penthouse

Interior view of underside of decking showing rust near drain piping.

Penthouse – P-3

Overview of the roof area.

Penthouse – P-3

Deteriorated sealant at termination bar at base of wall.

Penthouse – P-3

Rust at roof top supports.

Penthouse – P-3

Diagonal wrinkles at corner of base flashing indicating shrinkage of roofing system.

Penthouse – P-3

Open seam at roof membrane.

Penthouse – P-2

Overview of the roof area. Note ponding water at inlet gutter.

Penthouse – P-2

Overview of the roof area.

Penthouse – P-2

Backing out of insulation fasteners and potentially creating holes in membrane.

Penthouse – P-2

Hole through roof membrane allowing moisture infiltration.

Penthouse – P-2

Deteriorated sealant at roof membrane seams.

Penthouse – P-2

Rust at roof penetration and sealant deterioration at base flashing.

Penthouse – P-2

Deficient adhesion of base flashing at pipe penetration.

Penthouse – P-2

Open base flashing seam allowing ponding water to enter roof system.

Penthouse – P-4

Overview of the roof area.

Penthouse – P-4

Brick masonry debris indicating signs of masonry wall failure from moisture infiltration.

Penthouse – P-6

Overview of the roof area.

Penthouse – P-6

Deteriorated sealant at termination bar. Note brick masonry debris.

Penthouse – P-5

Overview of the roof area.

Penthouse – P-5

Signs of ponding water spots and minor surface erosion.

Maintenance Building

Overview of the maintenance building.

Maintenance Building – M-1

Overview of the roof area. Good condition overall.

Maintenance Building – M-1

Overview of the roof area. Good condition overall.

Maintenance Building – M-1

Debris accumulation on roof surface from overhanging tree.

Maintenance Building – M-1

Minor spots of rust at door lintel.

Ammonia Building – A-1

Overview of the ammonia building.

Ammonia Building – A-1

Overview of the roof area.

Ammonia Building – A-1

Minor spots of coating deterioration.

Generator Building – G-1

Overview of the generator building.

Generator Building – G-1

Overview of the roof area.

Generator Building – G-1

Deteriorated mortar at coping joints. Joints should be sealed using a sealant and backer rod in lieu of mortar.

Generator Building – G-1

Minor spots of rust at counterflashing metal.

Ozone Building

Overview of the ozone building.

Ozone Building – OZ-1

Overview of the roof area.

Ozone Building – OZ-1

Deteriorated sealant at pipe projection at pipe boot and clamping ring.

Ozone Building – OZ-1

Ponding water near perimeter edge scupper.

Ozone Building – OZ-1

Shaling of ballast creating sharp objects that can penetrate the roof system.

Ozone Building – OZ-1

Hole in base flashing of skylight potentially allowing moisture infiltration.

Ozone Building – OZ-1

Deterioration of mortar at coping joint.

Ozone Building – OZ-1

Base flashing delamination due to deficient adhesion.

Ozone Building – OZ-1

Open base flashing seam allowing potential water infiltration.

Ozone Building

Interior photo of underside of pre-cast concrete decking.

Re-carb Building

Overview of re-carb building.

Re-carb Building – RC-1

Overview of the roof area.

Re-carb Building – RC-1

Low-flashing height of exhaust fan and could allow water infiltration if ponding water occurs.

Re-carb Building – RC-1

Overview of scupper at perimeter edge.

EQ Building

Overview of the EQ building.

EQ Building – EQ-1

Overview of the roof area.

EQ Building – EQ-1

Overview of the roof area. Note stained surface indicating previous ponding conditions.

EQ Building – EQ-1

Mineral granule accumulation in corner of roof area from capsheet surfacing.

EQ Building – EQ-1

Missing/deteriorated mortar at coping bed joint.

EQ Building – EQ-1

Blisters throughout roof surface indicating water infiltration.

EQ Building – EQ-1

Open base flashing corner at exhaust fan.

Core Sample – Control Room – CR-1

Core sample at Control Room Area CR-1. The CR-1 roofing system consists of (from the top-down): Ballasted EPDM roof membrane, one layer of 1.5 inch thick polyisocyanurate insulation, a vapor barrier and a concrete deck.

Core Sample – EQ Building – EQ-1

Core sample at EQ Building Area EQ-1. The EQ-1 roofing system consists of (from the top-down): 2-ply Modified Bitumen roof system, one layer 0.5 wood fiber insulation, 1.0 inch thick polyisocyanurate insulation, adhered base sheet and a concrete deck.

Core Sample – Filter Gallery – F-2

Core Sample at Filter Gallery Area F-2. The F-2 roofing system consists of (from the top-down): Fully adhered EPDM roof membrane, one layer of 2.0 inch thick fiberglass insulation, a vapor barrier and a concrete deck.

Core Sample – Filter Gallery – F-5

Core Sample at Filter Gallery Area F-5. The F-5 roofing system consists of (from the top-down): Fully adhered EPDM roof membrane, one layer 1.0 inch phenolic foam insulation, and a concrete deck.

Core Sample – Filter Press – FP-1

Core sample at Filter Press Area FP-1. The FP-1 roofing system consists of (from the top-down): Ballasted EPDM roof membrane, two layers of 1.5 inch thick polyisocyanurate insulation, a vapor barrier and a concrete deck.

Core Sample – Penthouse – P-1

Core sample at Penthouse Area P-1. The P-1 roofing system consists of (from the top-down): Ballasted EPDM roof membrane, one layer of 1.5 inch thick polyisocyanurate insulation, a built-up roof system and a concrete deck.

StructureTec
Regional Offices/Administration - Detroit
34119 W. Twelve Mile Road, Ste. 270 • Farmington Hills, MI 48331
(800) 745-STEC (7832) • FAX (248) 848-1813 • www.structuretec.com

Solutions for the Built Environment

PHOTO REPORT - OUTSTATIONS

Barton Pumping Station

Overview of the roof area.

Barton Pumping Station

Overview of the roof area.

Barton Pumping Station

Overview of the roof area.

Barton Pumping Station

Low soil pipe height. Industry recommendation is 8” above roof surface.

Barton Pumping Station

Exposed termination bar at masonry wall. Flashing repairs noted, signs of previous issues.

Barton Pumping Station

Water on masonry wall. Signs of water within masonry system additional evaluation recommended.

Barton Pumping Station

Strip-in flashing repairs noted. Signs of previous issues of roof system.

Barton Pumping Station

Rust noted at vent pipe. Anti-corrosive coating recommended to prevent condition from worsening.

Barton Pumping Station

Holes in strip-in flashing likely from thermal shrinkage of roof system.

Barton Pumping Station

Buckled insulation noted. This condition could be related to moisture infiltration/wet insulation.

Barton Pumping Station

Holes in strip-in flashing likely from thermal shrinkage of roof system. Note weathered and deteriorated materials.

Barton Pumping Station

Vegetative growth near drain. Remove vegetation to prevent root growth/penetration through roof system.

Barton Pumping Station

Low flashing height at vent pipe.

Barton Pumping Station

Roof panels in good condition. Monitor fasteners and debris accumulation in gutters to prevent issues.

Industrial Pumping Station

Overview of the industrial pumping station.

Industrial Pumping Station

Overview of the roof area.

Industrial Pumping Station

Minor wrinkles at corners of roof system.

Industrial Pumping Station

Fasteners backing out. This condition can worsen if fasteners back out through roof membrane.

Industrial Pumping Station

Debris accumulation on roof surface. Monitor condition.

Industrial Pumping Station

Minor tenting at perimeter flashing. Note with this type of roofing system the flashings are not adhered in place, resulting in unsupported flashing.

Industrial Pumping Station

Patches at perimeter flashing. Previous issues possible.

Industrial Pumping Station

Multiple spots of caulking. Suspected puncture repair.

Industrial Pumping Station

Ponding water on roof surface.

Industrial Pumping Station

Rust at steel lintel above window.

Industrial Pumping Station

Overview of underside of concrete decking.

Industrial Pumping Station

Overview of underside of metal decking.

North Campus Pumping Station

Overview of the north campus pumping station.

North Campus Pumping Station

Overview of the roof area. Note spots of ponding water.

North Campus Pumping Station

Blisters at membrane seam cover strip.

North Campus Pumping Station

Open base flashing at exhaust fan allowing water infiltration.

North Campus Pumping Station

Open base flashing at exhaust fan allowing water infiltration. Note outdated seaming technology, glued seams.

North Campus Pumping Station

Rusted fasteners at perimeter edge metal. Poor detailing when using a horizontal fastening layout at perimeter edging.

North Campus Pumping Station

Low flashing height at pipe projection curb.

North Campus Pumping Station

Fastener backout at perimeter edge base flashing and will create holes in the roof system.

North Campus Pumping Station

Ponding water on roof surface.

North Campus Pumping Station

Rust corrosion at pipe.

North Campus Pumping Station

Interior photo of underside of pre-cast concrete decking and showing minor staining.

Superior Hydroelectric Pumping Station

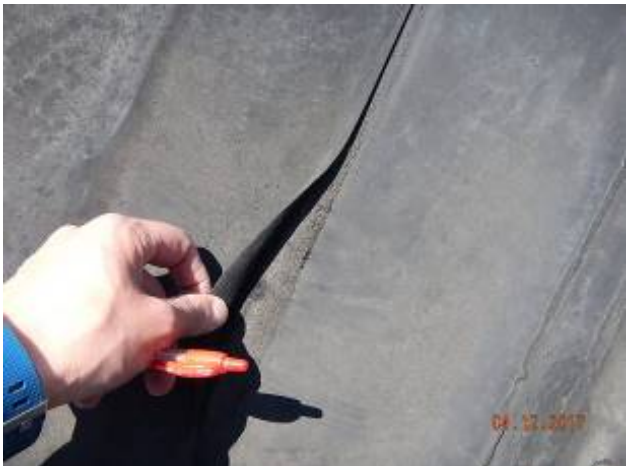
Overview of the superior hydroelectric pumping station.

Superior Hydroelectric Pumping Station

Overview of the roof area. Note surface erosion of membrane throughout.

Superior Hydroelectric Pumping Station

Overview of the roof area. Note surface erosion of membrane throughout.



Superior Hydroelectric Pumping Station

Deficient adhesion of membrane seams.

Superior Hydroelectric Pumping Station

Deficient adhesion of roof membrane patches.

Superior Hydroelectric Pumping Station

Ponding water at perimeter edge.

Superior Hydroelectric Pumping Station

Splitting at base flashing strip-in and rust along perimeter edge metal.

Superior Hydroelectric Pumping Station

Rust at perimeter edge metal.

Superior Hydroelectric Pumping Station

Interior photo of underside of metal decking.

Liberty Pumping Station

Overview of the roof area. Note spots of ponding water throughout.

Liberty Pumping Station

Overview of the roof area. Note spots of ponding water throughout.

Liberty Pumping Station

Fastener backout at membrane seams and can potentially create holes in roofing system.

Liberty Pumping Station

Debris accumulation at roof drain from nearby trees.

Liberty Pumping Station

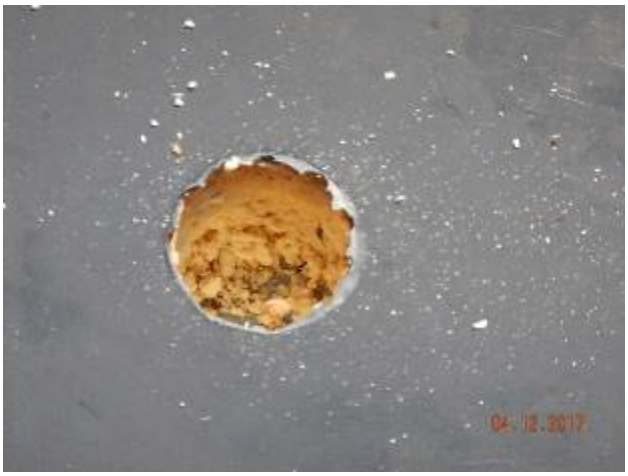
Sealant deterioration a pipe vent.

Core Sample – Barton Pumping – BP-1

Core sample at Barton Pumping Area BP-1. The BP-1 roofing system consists of (from the top-down): Ballasted EPDM roof membrane, two layers of 1.0 inch thick (wet) polyisocyanurate insulation, a built-up roof system, two layers 1.0 inch thick wood fiber insulation and a concrete deck.

Core Sample – North Campus Pumping – NC-1

Core sample at Liberty Pumping Area NC-1. The NC-1 roofing system consists of (from the top-down): Fully adhered EPDM roof membrane, one layer of 2.0 inch thick polyisocyanurate insulation, one layer of 1.0 inch thick (wet) polystyrene insulation and a metal deck.



Core Sample – Superior Hydroelectric – SH-1

Cores sample at Superior Hydroelectric Area SH-1. The SH-1 roofing system consists of (from the top-down): Fully adhered EPDM roof membrane, one layer of 0.5 inch thick phenolic foam insulation, two layers of polyisocyanurate insulation and a metal deck.

PHOTO REPORT – WATER TREATMENT

Admin Building – AD-1

Overview of the roof area.

Admin Building – AD-1

Overview of the roof area.

Admin Building – AD-1

Overview of the roof area.

Admin Building – AD-1

Overview of the roof area.

Admin Building – AD-1

Overview of the roof area.

Admin Building – AD-1

Overview of the roof area.

Admin Building – AD-1

Shaling of ballast creating sharp objects that can penetrate the roof system.

Admin Building – AD-1

Ponding water noted due to lack of slope at wall.

Admin Building – AD-1

Missing fasteners at ladder. Install appropriate fasteners to avoid holes in flashing due to ladder movement.

Admin Building – AD-1

Hole in flashing transition. Install appropriate flashing patch.

Admin Building – AD-1

Low flashing boot at penetration. Needs to be raised to 8” from roof surface or install new flashing boot.

Admin Building – AD-1

Deteriorated penetration filler at pipe. Recommend installing new penetration filler with rain collar watershed.

Admin Building – AD-1

Deteriorated sealant at EPDM patch in between copings. Additional sheet metal flashing is required.

Admin Building – AD-1

Small holes in flashing likely from dragging equipment near wall. Provide appropriate flashing patch.

Admin Building – AD-3

Overview of the roof area.

Admin Building – AD-3

Overview of the roof area.

Admin Building – AD-3

Minor deterioration of flashing. Monitor to prevent failure of flashing.

Admin Building – AD-3

Blisters and mineral granule loss on roof surface. Monitor to see if condition worsens.

Admin Building – AD-3

Note masonry cracking at corner of parapet wall transition. Additional evaluation of masonry recommended.

Admin Building – AD-2

Overview of roof area above building entry.

Admin Building – AD-2

Overview of the roof area.

Admin Building – AD-2

Overview of the roof area.

Admin Building – AD-2

Overview of the roof area.

Admin Building – AD-2

Signs of leakage at lintel below roof system. Additional evaluation of masonry recommended.

Control Rooms – CR-1

Overview of the roof area.

Control Rooms – CR-1

Overview of the roof area.

Control Rooms – CR-1

Overview of the roof area.

Control Rooms – CR-1

Vegetative growth on roof surface. Note masonry wall mortar deterioration.

Control Rooms – CR-1

Concrete coping loose and mortar deteriorated. Immediate corrective action is recommended.

Control Rooms – CR-1

Deteriorated mortar at concrete coping. Additional evaluation needed.

Control Rooms – CR-1

Deteriorated sealant at termination bar. Unsealed termination bar can allow for water infiltration. Note area of exposed masonry between coping flashing and termination bar, this area can allow for moisture ingress and should be covered.

Control Rooms – CR-1

Deteriorated sealant at termination bar. Unsealed termination bar can allow for water infiltration.

Control Rooms – CR-1

Deteriorated mortar at base of coping and at corner transition. Additional evaluation recommended.

Control Rooms – CR-1

Flaking of brick masonry due to moisture infiltration. Additional evaluation recommended.

Control Rooms – CR-1

Flaking of brick masonry due to moisture infiltration indicative of inadequate flashing system below coping stones. Additional evaluation recommended.

Control Rooms – CR-1

Overview of fiberglass skylight panels.

Control Rooms – CR-1

Deteriorated/missing gasket at skylight fasteners. Replace with new fasteners and gaskets to prevent potential for water infiltration.

Control Rooms – CR-1

Overview of rooftop concrete pad.

Control Rooms – CR-1

Minor deterioration of sealant at termination bar. Monitor condition to see if it worsens.

Control Rooms – CR-1

Rust at brick lintel and signs of moisture infiltration. Additional evaluation of masonry wall recommended.

Control Rooms – CR-1

Wrinkles at base flashing, related to shrinkage of roof system and no perimeter securement using fasteners. Note vegetation growth on roof surface.

Control Rooms – CR-1

Displaced aggregate and vegetation growth on roof surface.

Control Rooms – CR-2

Overview of the roof area.

Control Rooms – CR-2

Overview of the roof area.

Control Rooms – CR-2

Overview of the roof area.

Control Rooms – CR-2

Overview of the roof area.

Control Rooms – CR-2

Vegetation growth on roof surface. Remove vegetation to prevent any potential root penetration in roof surface.

Control Rooms – CR-2

Overview of metal closure piece. Note lifting of metal, needs to be re-secured/sealed.

Control Rooms – CR-2

Exposed termination bar at wall. This condition relies on sealant to prevent water intrusion. The correct design should include a counterflashing over the termination bar.

Control Rooms – CR-2

Cracked masonry noted. Additional evaluation recommended.

Control Rooms – CR-2

Ladder not fixed to the wall and support is working it's way through the base flashing. Secure ladder through wall to prevent movement.

Control Rooms – CR-2

Vegetation growth on roof surface. Recommend removal of vegetation.

WHS Building – WHS-1

Overview of the roof area.

WHS Building – WHS-1

Overview of the roof area.

WHS Building – WHS-1

Overview of the roof area.

WHS Building – WHS-1

Overview of the roof area.

WHS Building – WHS-1

Overview of flashing at perimeter concrete coping. Monitor unsecure termination of counterflashing for future issues. Note the flashing has a negative slope and seam integrity is suspect.

WHS Building – WHS-1

Overview of penetration flashing. No issues noted.

WHS Building – WHS-1

Overview of power ventilator flashing. No issues noted.

WHS Building – WHS-1

Overview of roof surface. Minor ponding noted.

WHS Building – WHS-1

Open flashing at pipe penetration. Recommend resealing flashing, consider contractor guarantee claim since the lap sealant is missing and detail is not adequate.

WHS Building – WHS-1

Overview of coping flashing tie-in. Monitor to ensure flashing does not fail. Additional metal is necessary as this is an unreliable detail.

WHS Building – WHS-1

Overview of ladder assembly.

WHS Building – WHS-1

Overview of manufacturer's stamp. 90mil EPDM and likely installed in 2016.

Filter Gallery – F-5

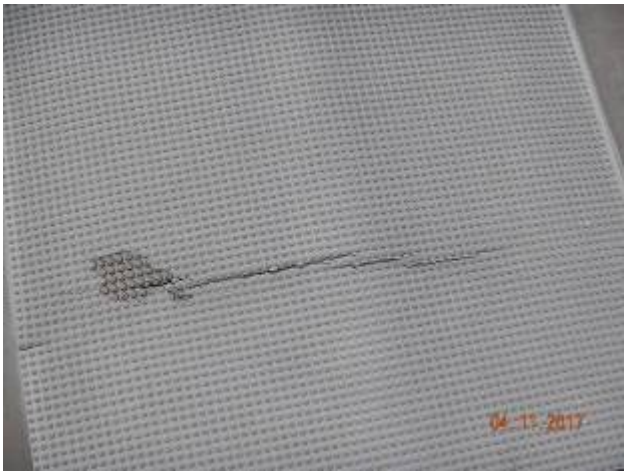
Overview of the roof area.

Filter Gallery – F-5

Cracks at brick masonry. Note exposed termination bar. If the sealant fails water can infiltrate, it is better design to install a counterflashing over termination bars. Note masonry flashing/weep system not evident if/how masonry drains is unknown.

Filter Gallery – F-5

Membrane adhesive deteriorated likely due to age. System is at end of its service life.



Filter Gallery – F-5

Cracked walkway pad due to system deterioration.

Filter Gallery – F-5

Deteriorated flashing adhesion. Roof system should be replaced.

Filter Gallery – F-5

Walkway pad adhesive failing.

Filter Gallery – F-5

Flashing seam reinforcing starting to show due to overall deterioration.

Filter Gallery – F-5

Exposed termination bar at roof system transition. Inadequate detailing.

Filter Gallery – F-5

Sealant deterioration at expansion joint termination bar.

Filter Gallery – F-2

Overview of the roof area.

Filter Gallery – F-2

Overview of the roof area.

Filter Gallery – F-2

Fastener backed out through perimeter edge flashing. Hole will need to be patched to limit moisture ingress until time of replacement.

Filter Gallery – F-2

Deficient adhesion at membrane seams. Recommend roof replacement due failure of seams.

Filter Gallery – F-2

Deficient adhesion to membrane field patch. Signs of previous system issues.

Filter Gallery – F-2

Deficient adhesion of roof walkpads.

Filter Gallery – F-2

Overview of the roof area.

Filter Gallery – F-2

Deficient adhesion of perimeter edge patches. Recommend replacement of roof system.

Filter Gallery – F-2

Deficient adhesion of field patches on roof membrane. Signs of deficient adhesive of glued seams is related to older EPDM system with outdated seaming technology.

Filter Gallery – F-3

Overview of the roof area.

Filter Gallery – F-3

Shaling of ballast rocks which creates shards that can penetrate roof surface.

Filter Gallery – F-3

Diagonal wrinkles at base flashing corner. Signs of shrinkage of EPDM membrane and inadequate securement at transition. Recommend replacement as the system is experiencing failure.

Filter Gallery – F-3

Shrinkage of base flashing of EPDM system. Recommend replacement as the system is experiencing failure.

Filter Gallery – F-3

Manufacturer's stamp is 1989 by Firestone.

Filter Gallery – F-3

Loose counterflashing.

Filter Gallery – F-3

Overview of ladders. Recommend replacing at time of roof replacement as there is significant rust present.

Filter Gallery – F-3

Cracks at concrete masonry termination at brick. Additional evaluation recommended.

Filter Gallery – F-3

Overview of roof level clerestory windows. Monitor sealant to prevent leakage or failure of seal. Additional evaluation/water testing recommended to evaluate system.

Filter Gallery – F-3

Deteriorated of glazing sealant noted at clerestory windows.

Filter Gallery – F-3

Gasket failure at clerestory window.

Filter Gallery – F-3

Cracks at concrete wall adjacent to clerestory windows.

Filter Gallery – F-3

Open flashing seam. Recommend re-sealing to minimize water infiltration until roof replacement.

Filter Gallery – F-3

Major base flashing shrinkage noted. Recommend roof replacement.

Filter Gallery – F-4

Overview of the roof area.

Filter Gallery – F-4

Diagonal wrinkles at base flashing. Thermal shrinkage of roof system noted.

Filter Gallery – F-4

Deteriorated mortar at concrete coping stones. Additional evaluation recommended.

Filter Gallery – F-4

Exposed reinforcing at concrete wall. Additional evaluation recommended.

Filter Gallery – F-4

Major base flashing shrinkage noted. Recommend roof replacement.

Filter Gallery – F-4

Hole in base flashing. Will likely propagate into larger tear during thermal cycle.

Filter Gallery – F-4

Major base flashing shrinkage noted. Recommend roof replacement.

Filter Gallery – F-4

Exposed termination bar at expansion joint. Note deteriorated sealant at termination bar.

Filter Gallery – F-4

Shaling of brick masonry. Signs of water infiltration within masonry wall. Additional evaluation recommended.

Filter Gallery – F-4

Vegetation growth on roof surface.

Filter Gallery – F-4

Rust at counterflashing. Signs of water within the wall system.

Filter Gallery – F-4

Overview of roof level clerestory windows.

Filter Gallery – F-4

Caulking over clerestory windows. Signs of previous issues at window system. Additional evaluation recommended.

Filter Gallery – F-4

Shaling of ballast rocks which creates shards that can penetrate roof surface.

Filter Gallery – F-7

Overview of the roof area. Note vegetation growth on roof surface.

Filter Gallery – F-7

Shaling of brick masonry. Signs of water within masonry wall. Additional evaluation recommended.

Filter Gallery – F-7

Exposed termination bar. If the sealant fails water can infiltrate, it is better design to install a counterflashing over termination bars.

Filter Gallery – F-7

Deteriorated mortar and brick at masonry transition. Additional evaluation recommended as it the wall system appears to have issues with moisture infiltration leading to continued degradation of masonry and roof system.

Filter Gallery – F-7

Open base flashing at base of masonry wall. Hole needs to be patched to limit moisture infiltration.

Filter Gallery – F-7

Rust at roof vent penetration.

Filter Gallery – F-7

Overview of roof level clerestory windows.

Filter Gallery – F-7

Failed gasket at clerestory window. Near areas of reported leakage. Additional evaluation recommended to determine corrective action.

Filter Gallery – F-7

Deteriorated sealant at window frame terminations. Additional evaluation recommended to determine corrective action.

Filter Gallery – F-7

Open flashing at roof expansion joint above clerestory windows. Roofing replacement will correct this condition.

Filter Gallery – F-1

Overview of the roof area.

Filter Gallery – F-1

Overview of the roof area.

Filter Gallery – F-1

Corrosion at vent wall penetration. Anti-corrosive treatment recommended.

Filter Gallery – F-1

Open masonry joint at concrete and brick termination. Re-seal with appropriate masonry sealant.

Filter Gallery – F-1

Exposed termination bar at concrete wall.

Filter Gallery – F-1

Vegetation growth on roof surface.

Filter Gallery – F-1

Mortar failure at concrete coping joint. Additional evaluation recommended for masonry repairs.

Filter Gallery – F-1

Vertical cracking through brick masonry. Likely moisture within wall. Additional evaluation recommended for masonry repairs in conjunction with any future roof replacement.

Filter Gallery – F-1

Open base flashing joint and termination bar failure. Water infiltration likely within system.

Filter Gallery – F-1

Base flashing shrinkage at concrete wall. Signs of thermal shrinkage of roof system relating to end of roof system life.

Filter Gallery – F-1

Base flashing shrinkage noted. Thermal shrinkage is related to end of service life for the roof system.

Filter Gallery – F-1

Rust noted at steel lintel at base of masonry coping.

Filter Gallery

Overview of underside of roof system.

Filter Gallery

Overview of concrete deck panels.

Filter Gallery

Cracking at concrete deck transition.

Filter Gallery

Rust noted at HVAC system.

Filter Gallery

Cracking on wall at base of clerestory window.

Filter Gallery

Water stains noted at clerestory windows. Obvious signs of leakage. Additional evaluation recommended to determine corrective action.

Filter Gallery

Rust at corner of clerestory window frame. Signs of water infiltration.

Filter Gallery

Coating at concrete peeling. Signs of water infiltration.

Rapid Mix Building – R-1

Overview of the roof area.

Rapid Mix Building – R-1

Overview of the roof area.

Rapid Mix Building – R-1

Shaling of ballast rocks which creates shards that can penetrate roof surface when subjected to roof top traffic.

Rapid Mix Building – R-1

Open base flashing at corner. Note exposed termination bar. Counterflashing should be installed and flashing sealed.

Rapid Mix Building – R-1

Split at perimeter strip-in at flange. Patch strip-in to prevent water infiltration.

Rapid Mix Building – R-1

Deficient adhesion at flashing strip-in. Strip-in should be replaced due to defects.

Rapid Mix Building – R-1

Dent at metal fascia likely from a lift or type of equipment.

Rapid Mix Building – R-1

Open flashing at metal flange termination. Patch/re-seal corner to prevent water infiltration.

Carbon House – CH-1

Overview of the roof area.

Carbon House – CH-1

Overview of the roof area.

Carbon House – CH-1

Base flashing pulling from wall showing old age of roofing system.

Carbon House – CH-1

Deteriorated sealant at base of stone coping.

Carbon House – CH-1

Flaking of brick masonry indicating signs of moisture infiltration.

Carbon House – CH-1

Deterioration of mortar at brick masonry wall.

Carbon House – CH-2

Overview of the roof area.

Carbon House – CH-2

Minor surface erosion throughout.

Filter Press – FP-1

Overview of the roof area.

Filter Press – FP-1

Overview of the roof area.

Filter Press – FP-1

Deteriorated sealant at clamping ring and flashing boot.

Filter Press – FP-1

Deteriorated sealant at metal coping seam.

Filter Press – FP-1

Rust at roof top unit curbs.

Filter Press – FP-1

Exposed/rusted fasteners at wall panel.

Filter Press – FP-1

Deteriorated sealant at top of counterflashing.

Filter Press – FP-1

Temporary flashing membrane cover over obsolete curb. Recommend installing a permanent metal cover or removing and decking over.

Filter Press – FP-1

Open flashing detail patch and can allow for moisture infiltration.

Filter Press – FP-1

Interior photo of underside of metal decking.

Calciner Building – CA-1

Overview of the roof area.

Calciner Building – CA-1

Overview of the roof area.

Calciner Building – CA-1

Debris on roofing surface.

Calciner Building – CA-1

Deteriorated sealant at metal coping seam.

Calciner Building – CA-1

Rust and paint failure at conduit pipe supports.

Calciner Building – CA-2

Overview of the roof area.

Penthouse – P-1

Overview of the roof area.

Penthouse – P-1

Overview of the roof area.

Penthouse – P-1

Missing/loose walkpads preventing foot traffic protection.

Penthouse – P-1

Deteriorated sealant at pipe boot and clamping ring. Note rusted pipe projection.

Penthouse – P-1

Deteriorated sealant at termination bar potentially allowing moisture infiltration.

Penthouse – P-1

Gasket failure at penthouse windows.

Penthouse – P-1

Stretching of pipe boots at pipe projections and sealant deterioration.

Penthouse – P-1

Flaking/deterioration of brick masonry wall showing signs of moisture infiltration suspected cause being the stone coping/flashing. Note previous masonry wall repairs/patches.

Penthouse – P-1

Core cut through roof system revealing water within system.

Penthouse

Interior view of underside of decking and masonry wall cracking.

Penthouse

Interior view of underside of decking showing rust near drain piping.

Penthouse – P-3

Overview of the roof area.

Penthouse – P-3

Deteriorated sealant at termination bar at base of wall.

Penthouse – P-3

Rust at roof top supports.

Penthouse – P-3

Diagonal wrinkles at corner of base flashing indicating shrinkage of roofing system.

Penthouse – P-3

Open seam at roof membrane.

Penthouse – P-2

Overview of the roof area. Note ponding water at inlet gutter.

Penthouse – P-2

Overview of the roof area.

Penthouse – P-2

Backing out of insulation fasteners and potentially creating holes in membrane.

Penthouse – P-2

Hole through roof membrane allowing moisture infiltration.

Penthouse – P-2

Deteriorated sealant at roof membrane seams.

Penthouse – P-2

Rust at roof penetration and sealant deterioration at base flashing.

Penthouse – P-2

Deficient adhesion of base flashing at pipe penetration.

Penthouse – P-2

Open base flashing seam allowing ponding water to enter roof system.

Penthouse – P-4

Overview of the roof area.

Penthouse – P-4

Brick masonry debris indicating signs of masonry wall failure from moisture infiltration.

Penthouse – P-6

Overview of the roof area.

Penthouse – P-6

Deteriorated sealant at termination bar. Note brick masonry debris.

Penthouse – P-5

Overview of the roof area.

Penthouse – P-5

Signs of ponding water spots and minor surface erosion.

Maintenance Building

Overview of the maintenance building.

Maintenance Building – M-1

Overview of the roof area. Good condition overall.

Maintenance Building – M-1

Overview of the roof area. Good condition overall.

Maintenance Building – M-1

Debris accumulation on roof surface from overhanging tree.

Maintenance Building – M-1

Minor spots of rust at door lintel.

Ammonia Building – A-1

Overview of the ammonia building.

Ammonia Building – A-1

Overview of the roof area.

Ammonia Building – A-1

Minor spots of coating deterioration.

Generator Building – G-1

Overview of the generator building.

Generator Building – G-1

Overview of the roof area.

Generator Building – G-1

Deteriorated mortar at coping joints. Joints should be sealed using a sealant and backer rod in lieu of mortar.

Generator Building – G-1

Minor spots of rust at counterflashing metal.

Ozone Building

Overview of the ozone building.

Ozone Building – OZ-1

Overview of the roof area.

Ozone Building – OZ-1

Deteriorated sealant at pipe projection at pipe boot and clamping ring.

Ozone Building – OZ-1

Ponding water near perimeter edge scupper.

Ozone Building – OZ-1

Shaling of ballast creating sharp objects that can penetrate the roof system.

Ozone Building – OZ-1

Hole in base flashing of skylight potentially allowing moisture infiltration.

Ozone Building – OZ-1

Deterioration of mortar at coping joint.

Ozone Building – OZ-1

Base flashing delamination due to deficient adhesion.

Ozone Building – OZ-1

Open base flashing seam allowing potential water infiltration.

Ozone Building

Interior photo of underside of pre-cast concrete decking.

Re-carb Building

Overview of re-carb building.

Re-carb Building – RC-1

Overview of the roof area.

Re-carb Building – RC-1

Low-flashing height of exhaust fan and could allow water infiltration if ponding water occurs.

Re-carb Building – RC-1

Overview of scupper at perimeter edge.

EQ Building

Overview of the EQ building.

EQ Building – EQ-1

Overview of the roof area.

EQ Building – EQ-1

Overview of the roof area. Note stained surface indicating previous ponding conditions.

EQ Building – EQ-1

Mineral granule accumulation in corner of roof area from capsheet surfacing.

EQ Building – EQ-1

Missing/deteriorated mortar at coping bed joint.

EQ Building – EQ-1

Blisters throughout roof surface indicating water infiltration.

EQ Building – EQ-1

Open base flashing corner at exhaust fan.

Core Sample – Control Room – CR-1

Core sample at Control Room Area CR-1. The CR-1 roofing system consists of (from the top-down): Ballasted EPDM roof membrane, one layer of 1.5 inch thick polyisocyanurate insulation, a vapor barrier and a concrete deck.

Core Sample – EQ Building – EQ-1

Core sample at EQ Building Area EQ-1. The EQ-1 roofing system consists of (from the top-down): 2-ply Modified Bitumen roof system, one layer 0.5 wood fiber insulation, 1.0 inch thick polyisocyanurate insulation, adhered base sheet and a concrete deck.

Core Sample – Filter Gallery – F-2

Core Sample at Filter Gallery Area F-2. The F-2 roofing system consists of (from the top-down): Fully adhered EPDM roof membrane, one layer of 2.0 inch thick fiberglass insulation, a vapor barrier and a concrete deck.

Core Sample – Filter Gallery – F-5

Core Sample at Filter Gallery Area F-5. The F-5 roofing system consists of (from the top-down): Fully adhered EPDM roof membrane, one layer 1.0 inch phenolic foam insulation, and a concrete deck.

Core Sample – Filter Press – FP-1

Core sample at Filter Press Area FP-1. The FP-1 roofing system consists of (from the top-down): Ballasted EPDM roof membrane, two layers of 1.5 inch thick polyisocyanurate insulation, a vapor barrier and a concrete deck.

Core Sample – Penthouse – P-1

Core sample at Penthouse Area P-1. The P-1 roofing system consists of (from the top-down): Ballasted EPDM roof membrane, one layer of 1.5 inch thick polyisocyanurate insulation, a built-up roof system and a concrete deck.

StructureTec
Regional Offices/Administration - Detroit
34119 W. Twelve Mile Road, Ste. 270 • Farmington Hills, MI 48331
(800) 745-STEC (7832) • FAX (248) 848-1813 • www.structuretec.com

Solutions for the Built Environment

PHOTO REPORT - OUTSTATIONS

Barton Pumping Station

Overview of the roof area.

Barton Pumping Station

Overview of the roof area.

Barton Pumping Station

Overview of the roof area.

Barton Pumping Station

Low soil pipe height. Industry recommendation is 8” above roof surface.

Barton Pumping Station

Exposed termination bar at masonry wall. Flashing repairs noted, signs of previous issues.

Barton Pumping Station

Water on masonry wall. Signs of water within masonry system additional evaluation recommended.

Barton Pumping Station

Strip-in flashing repairs noted. Signs of previous issues of roof system.

Barton Pumping Station

Rust noted at vent pipe. Anti-corrosive coating recommended to prevent condition from worsening.

Barton Pumping Station

Holes in strip-in flashing likely from thermal shrinkage of roof system.

Barton Pumping Station

Buckled insulation noted. This condition could be related to moisture infiltration/wet insulation.

Barton Pumping Station

Holes in strip-in flashing likely from thermal shrinkage of roof system. Note weathered and deteriorated materials.

Barton Pumping Station

Vegetative growth near drain. Remove vegetation to prevent root growth/penetration through roof system.

Barton Pumping Station

Low flashing height at vent pipe.

Barton Pumping Station

Roof panels in good condition. Monitor fasteners and debris accumulation in gutters to prevent issues.

Industrial Pumping Station

Overview of the industrial pumping station.

Industrial Pumping Station

Overview of the roof area.

Industrial Pumping Station

Minor wrinkles at corners of roof system.

Industrial Pumping Station

Fasteners backing out. This condition can worsen if fasteners back out through roof membrane.

Industrial Pumping Station

Debris accumulation on roof surface. Monitor condition.

Industrial Pumping Station

Minor tenting at perimeter flashing. Note with this type of roofing system the flashings are not adhered in place, resulting in unsupported flashing.

Industrial Pumping Station

Patches at perimeter flashing. Previous issues possible.

Industrial Pumping Station

Multiple spots of caulking. Suspected puncture repair.

Industrial Pumping Station

Ponding water on roof surface.

Industrial Pumping Station

Rust at steel lintel above window.

Industrial Pumping Station

Overview of underside of concrete decking.

Industrial Pumping Station

Overview of underside of metal decking.

North Campus Pumping Station

Overview of the north campus pumping station.

North Campus Pumping Station

Overview of the roof area. Note spots of ponding water.

North Campus Pumping Station

Blisters at membrane seam cover strip.

North Campus Pumping Station

Open base flashing at exhaust fan allowing water infiltration.

North Campus Pumping Station

Open base flashing at exhaust fan allowing water infiltration. Note outdated seaming technology, glued seams.

North Campus Pumping Station

Rusted fasteners at perimeter edge metal. Poor detailing when using a horizontal fastening layout at perimeter edging.

North Campus Pumping Station

Low flashing height at pipe projection curb.

North Campus Pumping Station

Fastener backout at perimeter edge base flashing and will create holes in the roof system.

North Campus Pumping Station

Ponding water on roof surface.

North Campus Pumping Station

Rust corrosion at pipe.

North Campus Pumping Station

Interior photo of underside of pre-cast concrete decking and showing minor staining.

Superior Hydroelectric Pumping Station

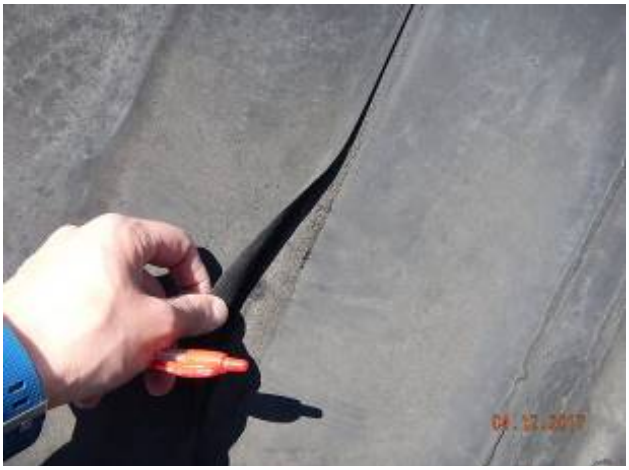
Overview of the superior hydroelectric pumping station.

Superior Hydroelectric Pumping Station

Overview of the roof area. Note surface erosion of membrane throughout.

Superior Hydroelectric Pumping Station

Overview of the roof area. Note surface erosion of membrane throughout.



Superior Hydroelectric Pumping Station

Deficient adhesion of membrane seams.

Superior Hydroelectric Pumping Station

Deficient adhesion of roof membrane patches.

Superior Hydroelectric Pumping Station

Ponding water at perimeter edge.

Superior Hydroelectric Pumping Station

Splitting at base flashing strip-in and rust along perimeter edge metal.

Superior Hydroelectric Pumping Station

Rust at perimeter edge metal.

Superior Hydroelectric Pumping Station

Interior photo of underside of metal decking.

Liberty Pumping Station

Overview of the roof area. Note spots of ponding water throughout.

Liberty Pumping Station

Overview of the roof area. Note spots of ponding water throughout.

Liberty Pumping Station

Fastener backout at membrane seams and can potentially create holes in roofing system.

Liberty Pumping Station

Debris accumulation at roof drain from nearby trees.

Liberty Pumping Station

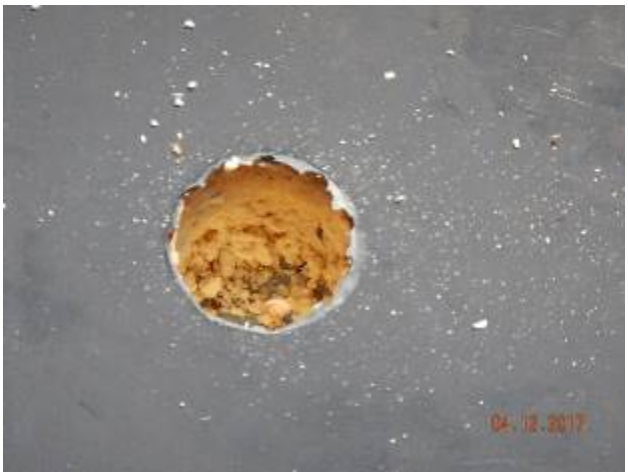
Sealant deterioration a pipe vent.

Core Sample – Barton Pumping – BP-1

Core sample at Barton Pumping Area BP-1. The BP-1 roofing system consists of (from the top-down): Ballasted EPDM roof membrane, two layers of 1.0 inch thick (wet) polyisocyanurate insulation, a built-up roof system, two layers 1.0 inch thick wood fiber insulation and a concrete deck.

Core Sample – North Campus Pumping – NC-1

Core sample at Liberty Pumping Area NC-1. The NC-1 roofing system consists of (from the top-down): Fully adhered EPDM roof membrane, one layer of 2.0 inch thick polyisocyanurate insulation, one layer of 1.0 inch thick (wet) polystyrene insulation and a metal deck.



Core Sample – Superior Hydroelectric – SH-1

Cores sample at Superior Hydroelectric Area SH-1. The SH-1 roofing system consists of (from the top-down): Fully adhered EPDM roof membrane, one layer of 0.5 inch thick phenolic foam insulation, two layers of polyisocyanurate insulation and a metal deck.

APPENDIX B

City of Ann Arbor

Water Treatment Plant

Activated Carbon Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
1	Third Level	Concrete Deck	1	756	Sq.Ft.	Negative
1	Third Level	Concrete Floor	2	756	Sq.Ft.	Negative
1	Third Level	Fiberglass Pipe Insulation	3	40	Ln.Ft.	Negative
1	Third Level	Fiberglass Pipe Fitting Insulation	4	2	Ln.Ft.	Negative
1	Third Level	Window Frame Caulk - Brown	5	80	Ln.Ft.	Negative
1	**Third Level**	**Fire Door**	**6**	**2**	**Total**	**Assumed**
1	Third Level	Ceramic Block - Yellow	8	1,500	Sq.Ft.	Negative
1	Third Level	Ceramic Block Mortar	9	1,500	Sq.Ft.	Negative
2	Second Level	Concrete Deck	1	756	Sq.Ft.	Negative
2	Second Level	Concrete Floor	2	756	Sq.Ft.	Negative
2	Second Level	Fiberglass Pipe Insulation	3	125	Ln.Ft.	Negative
2	Second Level	Fiberglass Pipe Fitting Insulation	4	14	Ln.Ft.	Negative
2	Second Level	Window Frame Caulk - Brown	5	100	Ln.Ft.	Negative
2	**Second Level**	**Fire Door**	**6**	**1**	**Total**	**Assumed**
2	Second Level	Door Frame Caulk - Gray	7	40	Ln.Ft.	Negative
2	Second Level	Ceramic Block - Yellow	8	1,500	Sq.Ft.	Negative
2	Second Level	Ceramic Block Mortar	9	1,500	Sq.Ft.	Negative
2	Second Level	Concrete Wall	35	1,200	Sq.Ft.	Negative
2	**Second Level**	**Welding Curtain**	**44**	**100**	**Sq.Ft.**	**Positive**
3	First Level	Concrete Deck	1	900	Sq.Ft.	Negative
3	First Level	Concrete Floor	2	900	Sq.Ft.	Negative
3	First Level	Concrete Wall - Coated Black	10	1,200	Sq.Ft.	Negative
3	**First Level**	**Pipe Gasket**	**11**			**Assumed**
4	Insturment Room	Concrete Deck	1	252	Sq.Ft.	Negative
4	Insturment Room	Fiberglass Pipe Insulation	3	3	Ln.Ft.	Negative
4	Insturment Room	Window Frame Caulk - Brown	5	60	Ln.Ft.	Negative
4	Insturment Room	2'x2' Ceiling Panels - Tiny Holes and Small Groves	12	252	Sq.Ft.	Negative
4	Insturment Room	Duct Joint Sealant - Gray	13	10	Sq.Ft.	Negative
4	Insturment Room	Drywall	14	1,100	Sq.Ft.	Negative
4	Insturment Room	Drywall Mud	15	1,100	Sq.Ft.	Negative
4	Insturment Room	Drywall Tape	16	1,100	Sq.Ft.	Negative
4	Insturment Room	12"x12" Floor Tile - Tan with Beige Specs	17	252	Sq.Ft.	Negative
4	Insturment Room	12"x12" Floor Tile - Tan with Beige Specs Mastic	18	252	Sq.Ft.	Negative
4	Insturment Room	4" Covebase - Tan	19	65	Ln.Ft.	Negative
4	Insturment Room	4" Covebase - Tan Mastic	20	65	Ln.Ft.	Negative
5	Gas Storage North	Concrete Floor	2	21	Sq.Ft.	Negative

City of Ann Arbor

Water Treatment Plant

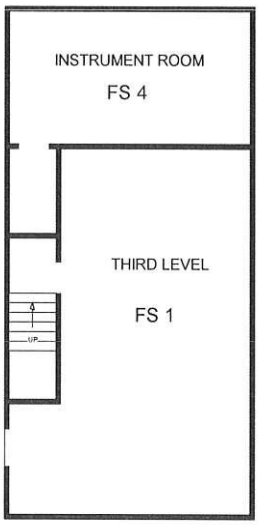
Activated Carbon Building

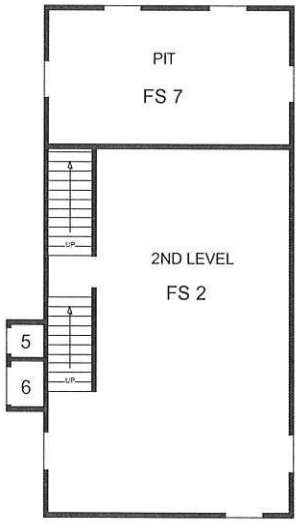
List by Functional Space

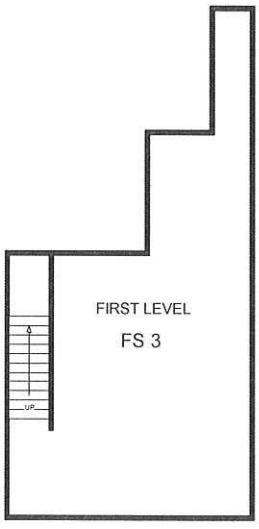
FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
5	Gas Storage North	Brick - Red	25	75	Sq.Ft.	Negative
5	Gas Storage North	Brick Mortar	26	75	Sq.Ft.	Negative
5	Gas Storage North	Cinderblock	27	50	Sq.Ft.	Negative
5	Gas Storage North	Cinderblock Mortar	28	50	Sq.Ft.	Negative
5	Gas Storage North	Wall Joint Caulk - Light Green	29	15	Ln.Ft.	Negative
5	Gas Storage North	Door Frame Caulk - Black	30	21	Ln.Ft.	Negative
6	Gas Storage South	Concrete Floor	2	25	Sq.Ft.	Negative
6	Gas Storage South	Brick - Red	25	48	Sq.Ft.	Negative
6	Gas Storage South	Brick Mortar	26	48	Sq.Ft.	Negative
6	Gas Storage South	Cinderblock	27	50	Sq.Ft.	Negative
6	Gas Storage South	Cinderblock Mortar	28	50	Sq.Ft.	Negative
6	Gas Storage South	Wall Joint Caulk - Light Green	29	15	Ln.Ft.	Negative
6	Gas Storage South	Door Frame Caulk - Black	30	18	Ln.Ft.	Negative
7	Pit Area	Concrete Floor	2	360	Sq.Ft.	Negative
7	Pit Area	Fiberglass Pad with Foil	32	360	Sq.Ft.	Negative
7	Pit Area	Fiberglass Pad with Glue Pod - Tan	33	360	Sq.Ft.	Negative
7	Pit Area	Brick - Gray	34	500	Sq.Ft.	Negative
7	Pit Area	Concrete Wall	35	500	Sq.Ft.	Negative
7	Pit Area	Brick - Gray Mortar	42	500	Sq.Ft.	Negative
8	Exterior	Exterior Brick	21	3,000	Sq.Ft.	Negative
8	Exterior	Exterior Door Frame Caulk - Gray	22	90	Ln.Ft.	Negative
8	Exterior	Exterior Brick Mortar	23	3,000	Sq.Ft.	Negative
8	Exterior	Exterior Wall Joint Caulk - Gray	24	30	Ln.Ft.	Negative
8	**Exterior**	**Exterior Lintel and Sill Caulk - Cream**	**31**	**66**	**Ln.Ft.**	**Positive**
8	Exterior	Exterior Sandstone Wall	36	300	Sq.Ft.	Negative
8	Exterior	Exterior Sandstone Wall Mortar	37	300	Sq.Ft.	Negative
8	Exterior	Exterior Window Frame Caulk - Gray	38	220	Ln.Ft.	Negative
8	Exterior	Exterior Window Frame Caulk - Black	39	220	Ln.Ft.	Negative
8	Exterior	Exterior Wall Joint Caulk - Old Gray	40	60	Ln.Ft.	Negative
8	**Exterior**	**Exterior Old Wood Frame Caulk - Old Gray**	**41**	**7**	**Ln.Ft.**	**Positive**
8	**Exterior**	**Exterior Window Glaze - Black**	**43**	**725**	**Ln.Ft.**	**Positive**
8	Exterior	Roof Cap Caulk	45	30	Ln.Ft.	Negative

CITY OF ANN ARBOR
WATER TREATMENT PLANT
ACTIVATED CARBON BUILDING
FUNCTIONAL SPACES

EXTERIOR = FS 8







City of Ann Arbor
Water Treatment Plant
Ammonia Building
List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
1	Interior	Concrete	1	240	Sq.Ft.	Negative
1	Interior	Drywall	2	600	Sq.Ft.	Negative
1	Interior	Drywall Tape	3	600	Sq.Ft.	Negative
1	Interior	Drywall Mud	4	600	Sq.Ft.	Negative
1	Interior	Door Frame Caulk - Gray	5	22	Ln.Ft.	Negative
1	Interior	Window Glaze - Black	6	18	Ln.Ft.	Negative
1	**Interior**	**Fire Door**	**7**	**2**	**Total**	**Assumed**
1	Interior	Fiberglass Pipe Insulation	8	15	Ln.Ft.	Negative
1	Interior	Fiberglass Pipe Fitting Insulation	9	9	Ln.Ft.	Negative
1	Interior	Fiberglass Tank Insulation	10	21	Ln.Ft.	Negative
2	Exterior	Exterior Door Frame Caulk - Black	11	22	Ln.Ft.	Negative
2	Exterior	Exterior Brick	12	660	Sq.Ft.	Negative
2	Exterior	Exterior Brick Mortar	13	660	Sq.Ft.	Negative
2	Exterior	Exterior Duct Selant - Gray	14	75	Ln.Ft.	Negative
2	Exterior	Exterior Concrete	15	15	Sq.Ft.	Negative
2	Exterior	Exterior Concrete Edge Caulk - Gray	16	20	Ln.Ft.	Negative
2	Exterior	Exterior Window Glaze - Black	17	18	Ln.Ft.	Negative

LIMITED BUILDING MATERIAL SURVEY OF
SUSPECT ASBESTOS CONTAINING MATERIALS

CITY OF ANN ARBOR - BARTON HYDRO STATION

INSPECTION DATE - 06/23/2015

HA #	ROOM# / LOCATION	FLOOR	DESCRIPTION	POS or NEG	QUANTITY	UPDATED STATUS
4	**Electrical Room**	**2**	**Fire Door**	**Assumed Positive**	**1 Door**	
17	**Exterior**	**-**	**Roof Tar Patch Compound on Window Ledge**	**Positive**	**3 l.f.**	
7	**Fuel Oil Room**	**1**	**Suspect Mag Pipe Insulation Debris**	**Positive**	**100 s.f.**	***All Material Abated as of 09/24/15***
10	**Lower Level**	**B**	**Door Frame Sealant - Dark Brown**	**Positive**	**5 l.f.**	
12	**Lower Level**	**B**	**Transite Panels**	**Positive**	**50 s.f.**	***All Material Abated as of 09/24/15***
13	**Lower Level**	**B**	**Packing in Pipe Penetrations**	**Positive**	**5" diameter hole - 4 Total**	***All Material Abated as of 09/24/15***
19	**Lower Level**	**B**	**Caulk on I-Beam**	**Positive**	**40 l.f.**	
14	**Lower Level**	**B**	**Electrical Wiring Extending from Conduit Penetration**	**Assumed Positive**	**Unknown**	
15	**Lower Level - Boiler Room**	**B**	**Boiler Wrap Insulation**	**Positive**	**100 s.f.**	***All Material Abated as of 09/24/15***
15A	**Lower Level - Boiler Room**	**B**	**Boiler Firebrick, Mortar or Refractory**	**Assumed Positive**	**-**	***All Material Abated as of 09/24/15***
16	**Lower Level - Boiler Room**	**B**	**Vermiculite and Debris on Floor**	**Assumed Positive**	**100 s.f.**	***All Material Abated as of 09/24/15***
6	**Storage Area**	**1M**	**Electrical Backing Panels - Black**	**Positive**	**40 s.f.**	***All Material Abated as of 09/24/15***
8	Hallway / Stairway	1	Window Caulk/Mortar Patch	Negative	30 l.f.	
9	Hallway / Stairway	1	Window Pane Rope	Negative	5 l.f.	
1	Turbine Operating Floor	2	Gray Window Glaze	Negative	5 l.f.	
1	Storage Area	1M	Gray Window Glaze	Negative	180 l.f.	
6A	Storage Area	1M	Electrical Wiring Associated with Electrical Backing Panels	Negative	5 l.f.	
1	Open Mezzanine Area	2M	Gray Window Glaze	Negative	900 l.f.	
2	Control Room	2M	Drywall, Tape and Mud	Negative	-	
3	Control Room	2M	Door Frame Sealant - Brown	Negative	30 l.f.	
1A	Open Mezzanine Area	2M	White Window Glaze (replacement)	Negative	Included in above quantity	
8	Lower Level	B	Window Caulk/Mortar Patch	Negative	30 l.f.	
11	Lower Level	B	Window Glaze - Red	Negative	30 l.f.	
18	Lower Level	B	Window Glaze - White	Negative	120 l.f.	
-	Abandonded Turbine Room	-	****No Access****			

Materials containing >1% asbestos are regulated asbestos containing materials

City of Ann Arbor
Water Treatment Plant
Calciner Building
List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
1	Level Seven	Concrete Deck	1	800	Sq.Ft.	Negative
1	Level Seven	Concrete Floor	2	800	Sq.Ft.	Negative
1	Level Seven	Cinderblock	4	450	Sq.Ft.	Negative
1	Level Seven	Cinderblock Mortar	5	450	Sq.Ft.	Negative
1	Level Seven	I-Beam and Column Trowell-On	9	590	Sq.Ft.	Negative
1	Level Seven	Duct Joint Selant - Cream	10	500	Sq.Ft.	Negative
1	Level Seven	Duct Expansion Joint Fabric - Black	11	75	Sq.Ft.	Negative
1	Level Seven	Concrete Deck Caulk - Tan	12	800	Ln.Ft.	Negative
1	Level Seven	Drywall	13	1,200	Sq.Ft.	Negative
1	Level Seven	Drywall Tape	14	1,200	Sq.Ft.	Negative
1	Level Seven	Drywall Mud	15	1,200	Sq.Ft.	Negative
2	Level Six	Concrete Floor	2	250	Sq.Ft.	Negative
2	Level Six	Cinderblock	4	200	Sq.Ft.	Negative
2	Level Six	Cinderblock Mortar	5	200	Sq.Ft.	Negative
2	Level Six	Fiberglass Pipe Insulation	6	100	Ln.Ft.	Negative
2	Level Six	Fiberglass Pipe Fitting Insulation	7	4	Ln.Ft.	Negative
2	Level Six	I-Beam and Column Trowell-On	9	150	Sq.Ft.	Negative
2	Level Six	Drywall	13	800	Sq.Ft.	Negative
2	Level Six	Drywall Tape	14	800	Sq.Ft.	Negative
2	Level Six	Drywall Mud	15	800	Sq.Ft.	Negative
2	**Level Six**	**Fire Door**	**18**	**2**	**Total**	**Assumed**
2	**Level Six**	**Fire Door Frame**	**19**	**2**	**Total**	**Assumed**
2	Level Six	Covebase - Cream	20	35	Ln.Ft.	Negative
2	Level Six	Covebase - Cream Mastic	21	35	Ln.Ft.	Negative
3	Level Five	Concrete Floor	2	700	Sq.Ft.	Negative
3	Level Five	Cinderblock	4	300	Sq.Ft.	Negative
3	Level Five	Cinderblock Mortar	5	300	Sq.Ft.	Negative
3	Level Five	Fiberglass Pipe Insulation	6	175	Ln.Ft.	Negative
3	Level Five	Fiberglass Pipe Fitting Insulation	7	22	Ln.Ft.	Negative
3	Level Five	I-Beam and Column Trowell-On	9	1,200	Sq.Ft.	Negative
3	Level Five	Duct Joint Selant - Cream	10	50	Sq.Ft.	Negative
3	Level Five	Drywall	13	2,500	Sq.Ft.	Negative
3	Level Five	Drywall Tape	14	2,500	Sq.Ft.	Negative
3	Level Five	Drywall Mud	15	2,500	Sq.Ft.	Negative
3	**Level Five**	**Fire Door**	**18**	**3**	**Total**	**Assumed**
3	**Level Five**	**Fire Door Frame**	**19**	**2**	**Total**	**Assumed**

City of Ann Arbor
Water Treatment Plant
Calciner Building
List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
3	Level Five	Covebase - Cream	20	150	Ln.Ft.	Negative
3	Level Five	Covebase - Cream Mastic	21	150	Ln.Ft.	Negative
3	Level Five	Fiberglass Duct Insulation with Foil	22	130	Sq.Ft.	Negative
3	Level Five	Deck Packing Fiberglass	23	40	Sq.Ft.	Negative
4	Level Four West	Cinderblock	4	500	Sq.Ft.	Negative
4	Level Four West	Cinderblock Mortar	5	500	Sq.Ft.	Negative
4	Level Four West	Duct Joint Selant - Cream	10	10	Sq.Ft.	Negative
4	Level Four West	Drywall	13	500	Sq.Ft.	Negative
4	Level Four West	Drywall Tape	14	500	Sq.Ft.	Negative
4	Level Four West	Drywall Mud	15	500	Sq.Ft.	Negative
4	**Level Four West**	**Fire Door**	**18**	**2**	**Total**	**Assumed**
4	**Level Four West**	**Fire Door Frame**	**19**	**2**	**Total**	**Assumed**
4	Level Four West	Fiberglass Duct Insulation with Foil	22	25	Sq.Ft.	Negative
4	Level Four West	Brick	24	350	Sq.Ft.	Negative
4	Level Four West	Brick Mortar	25	350	Sq.Ft.	Negative
4	Level Four West	Door Frame Caulk - Cream	26	35	Ln.Ft.	Negative
4	Level Four West	2'x2' Ceiling Tile - Flat	27	144	Sq.Ft.	Negative
4	Level Four West	Covebase - Rust	28	40	Ln.Ft.	Negative
4	Level Four West	Covebase - Rust Mastic	29	40	Ln.Ft.	Negative
4	Level Four West	I-Beam Spray-On	41	320	Sq.Ft.	Negative
5	Level Four North	Concrete Floor	2	10	Sq.Ft.	Negative
5	Level Four North	Cinderblock	4	840	Sq.Ft.	Negative
5	Level Four North	Cinderblock Mortar	5	840	Sq.Ft.	Negative
5	Level Four North	Fiberglass Pipe Insulation	6	150	Ln.Ft.	Negative
5	Level Four North	Fiberglass Pipe Fitting Insulation	7	5	Ln.Ft.	Negative
5	Level Four North	Duct Joint Selant - Cream	10	50	Sq.Ft.	Negative
5	Level Four North	Drywall	13	600	Sq.Ft.	Negative
5	Level Four North	Drywall Tape	14	600	Sq.Ft.	Negative
5	Level Four North	Drywall Mud	15	600	Sq.Ft.	Negative
5	Level Four North	Smooth Plaster Finish Coat	16	300	Sq.Ft.	Negative
5	Level Four North	Smooth Plaster Brown Coat	17	300	Sq.Ft.	Negative
5	**Level Four North**	**Fire Door**	**18**	**1**	**Total**	**Assumed**
5	**Level Four North**	**Fire Door Frame**	**19**	**1**	**Total**	**Assumed**
5	Level Four North	Door Frame Caulk - Cream	26	17	Ln.Ft.	Negative
5	Level Four North	Covebase - Rust	28	130	Ln.Ft.	Negative
5	Level Four North	Covebase - Rust Mastic	29	130	Ln.Ft.	Negative

City of Ann Arbor

Water Treatment Plant

Calciner Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
5	Level Four North	2'x2' Ceiling Tile - Tiny Holes, Small Grooves	30	792	Sq.Ft.	Negative
5	Level Four North	12"x12" Floor Tile - Cream with Beige Specs	31	792	Sq.Ft.	Negative
5	Level Four North	12"x12" Floor Tile - Cream with Beige Specs Mastic	32	792	Sq.Ft.	Negative
5	Level Four North	12"x12" Floor Tile - Blue with Light Blue Specs	33	7	Sq.Ft.	Negative
5	Level Four North	12"x12" Floor Tile - Blue with Light Blue Specs Mastic	34	7	Sq.Ft.	Negative
5	Level Four North	12"x12" Floor Tile - Red with Light Red Specs	35	7	Sq.Ft.	Negative
5	Level Four North	12"x12" Floor Tile - Red with Light Red Specs Mastic	36	7	Sq.Ft.	Negative
5	Level Four North	Window Frame Glaze - Rubber Black	37	25	Sq.Ft.	Negative
5	**Level Four North**	**Sink Undercoating - Gray**	**38**	**1**	**Total**	**Positive**
5	Level Four North	Wallpaper Mastic	39	600	Sq.Ft.	Negative
5	Level Four North	I-Beam Caulk - Gray	40	15	Ln.Ft.	Negative
6	Level Four East	Fiberglass Pipe Insulation	6	80	Ln.Ft.	Negative
6	Level Four East	Fiberglass Pipe Fitting Insulation	7	4	Ln.Ft.	Negative
6	Level Four East	Drywall	13	400	Sq.Ft.	Negative
6	Level Four East	Drywall Tape	14	400	Sq.Ft.	Negative
6	Level Four East	Drywall Mud	15	400	Sq.Ft.	Negative
6	**Level Four East**	**Fire Door**	**18**	**1**	**Total**	**Assumed**
6	**Level Four East**	**Fire Door Frame**	**19**	**1**	**Total**	**Assumed**
6	Level Four East	Covebase - Cream	20	70	Ln.Ft.	Negative
6	Level Four East	Covebase - Cream Mastic	21	70	Ln.Ft.	Negative
6	Level Four East	2'x2' Ceiling Tile - Tiny Holes, Small Grooves	30	240	Sq.Ft.	Negative
6	Level Four East	12"x12" Floor Tile - Cream with Beige Specs	31	240	Sq.Ft.	Negative
6	Level Four East	12"x12" Floor Tile - Cream with Beige Specs Mastic	32	240	Sq.Ft.	Negative
6	Level Four East	Wallpaper Mastic	39	400	Sq.Ft.	Negative
6	Level Four East	I-Beam Spray-On	41	300	Sq.Ft.	Negative
7	Men's Locker Room	Concrete Floor	2	980	Sq.Ft.	Negative
7	Men's Locker Room	Fiberglass Pipe Insulation	6	500	Ln.Ft.	Negative
7	Men's Locker Room	Fiberglass Pipe Fitting Insulation	7	50	Ln.Ft.	Negative
7	Men's Locker Room	Duct Joint Selant - Cream	10	300	Sq.Ft.	Negative
7	Men's Locker Room	Drywall	13	800	Sq.Ft.	Negative
7	Men's Locker Room	Drywall Tape	14	800	Sq.Ft.	Negative
7	Men's Locker Room	Drywall Mud	15	800	Sq.Ft.	Negative
7	Men's Locker Room	Smooth Plaster Finish Coat	16	980	Sq.Ft.	Negative
7	Men's Locker Room	Smooth Plaster Brown Coat	17	980	Sq.Ft.	Negative
7	Men's Locker Room	Fiberglass Duct Insulation with Foil	22	400	Sq.Ft.	Negative
7	Men's Locker Room	I-Beam Spray-On	41	1,200	Sq.Ft.	Negative

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7	Men's Locker Room	Smooth Plaster Edge Caulk - Cream	42	350	Ln.Ft.	Negative
8	Women's Locker Room	Concrete Floor	2	980	Sq.Ft.	Negative
8	Women's Locker Room	Fiberglass Pipe Insulation	6	500	Ln.Ft.	Negative
8	Women's Locker Room	Fiberglass Pipe Fitting Insulation	7	50	Ln.Ft.	Negative
8	Women's Locker Room	Duct Joint Selant - Cream	10	300	Sq.Ft.	Negative
8	Women's Locker Room	Drywall	13	400	Sq.Ft.	Negative
8	Women's Locker Room	Drywall Tape	14	400	Sq.Ft.	Negative
8	Women's Locker Room	Drywall Mud	15	400	Sq.Ft.	Negative
8	Women's Locker Room	Smooth Plaster Finish Coat	16	980	Sq.Ft.	Negative
8	Women's Locker Room	Smooth Plaster Brown Coat	17	980	Sq.Ft.	Negative
8	Women's Locker Room	Fiberglass Duct Insulation with Foil	22	400	Sq.Ft.	Negative
8	Women's Locker Room	I-Beam Spray-On	41	1,200	Sq.Ft.	Negative
8	Women's Locker Room	Smooth Plaster Edge Caulk - Cream	42	350	Ln.Ft.	Negative
8	Women's Locker Room	Batten Insulation - Yellow	43	8	Sq.Ft.	Negative
9	Level Three East	Drywall	13	400	Sq.Ft.	Negative
9	Level Three East	Drywall Tape	14	400	Sq.Ft.	Negative
9	Level Three East	Drywall Mud	15	400	Sq.Ft.	Negative
9	**Level Three East**	**Fire Door**	**18**	**4**	**Total**	**Assumed**
9	**Level Three East**	**Fire Door Frame**	**19**	**3**	**Total**	**Assumed**
9	Level Three East	Covebase - Cream	20	70	Ln.Ft.	Negative
9	Level Three East	Covebase - Cream Mastic	21	70	Ln.Ft.	Negative
9	Level Three East	2'x2' Ceiling Tile - Tiny Holes, Small Grooves	30	240	Sq.Ft.	Negative
9	Level Three East	12"x12" Floor Tile - Cream with Beige Specs	31	240	Sq.Ft.	Negative
9	Level Three East	12"x12" Floor Tile - Cream with Beige Specs Mastic	32	240	Sq.Ft.	Negative
9	Level Three East	Wallpaper Mastic	39	400	Sq.Ft.	Negative
9	Level Three East	I-Beam Spray-On	41	300	Sq.Ft.	Negative
9	Level Three East	Drywall Brown Coat Mud	45	400	Sq.Ft.	Negative
10	Level Three West	Concrete Floor	2	470	Sq.Ft.	Negative
10	Level Three West	Concrete Wall	3	100	Sq.Ft.	Negative
10	Level Three West	Cinderblock	4	600	Sq.Ft.	Negative
10	Level Three West	Cinderblock Mortar	5	600	Sq.Ft.	Negative
10	Level Three West	I-Beam and Column Trowell-On	9	75	Sq.Ft.	Negative
10	Level Three West	Drywall	13	600	Sq.Ft.	Negative
10	Level Three West	Drywall Tape	14	600	Sq.Ft.	Negative
10	Level Three West	Drywall Mud	15	600	Sq.Ft.	Negative
10	Level Three West	Covebase - Cream	20	75	Sq.Ft.	Negative

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10	Level Three West	Covebase - Cream Mastic	21	75	Sq.Ft.	Negative
10	Level Three West	Brick	24	150	Sq.Ft.	Negative
10	Level Three West	Brick Mortar	25	150	Sq.Ft.	Negative
10	Level Three West	2'x2' Ceiling Tile - Flat	27	350	Sq.Ft.	Negative
10	Level Three West	I-Beam Spray-On 2	44	500	Sq.Ft.	Negative
11	Room 203	Concrete Wall	3	170	Sq.Ft.	Negative
11	Room 203	Cinderblock	4	150	Sq.Ft.	Negative
11	Room 203	Cinderblock Mortar	5	150	Sq.Ft.	Negative
11	Room 203	Fiberglass Pipe Insulation	6	40	Ln.Ft.	Negative
11	Room 203	Fiberglass Pipe Fitting Insulation	7	3	Ln.Ft.	Negative
11	Room 203	Duct Joint Selant - Cream	10	50	Sq.Ft.	Negative
11	Room 203	Drywall	13	250	Sq.Ft.	Negative
11	Room 203	Drywall Tape	14	250	Sq.Ft.	Negative
11	Room 203	Drywall Mud	15	250	Sq.Ft.	Negative
11	**Room 203**	**Fire Door**	**18**	**2**	**Total**	**Assumed**
11	**Room 203**	**Fire Door Frame**	**19**	**2**	**Total**	**Assumed**
11	Room 203	Covebase - Cream	20	70	Sq.Ft.	Negative
11	Room 203	Covebase - Cream Mastic	21	70	Sq.Ft.	Negative
11	Room 203	2'x2' Ceiling Tile - Tiny Holes, Small Grooves	30	289	Sq.Ft.	Negative
11	Room 203	12"x12" Floor Tile - Cream with Beige Specs	31	289	Sq.Ft.	Negative
11	Room 203	12"x12" Floor Tile - Cream with Beige Specs Mastic	32	289	Sq.Ft.	Negative
11	Room 203	I-Beam Caulk - Gray	40	220	Ln.Ft.	Negative
12	Room 204	Concrete Floor	2	500	Sq.Ft.	Negative
12	Room 204	Cinderblock	4	200	Sq.Ft.	Negative
12	Room 204	Cinderblock Mortar	5	200	Sq.Ft.	Negative
12	Room 204	Duct Joint Selant - Cream	10	200	Sq.Ft.	Negative
12	Room 204	Drywall	13	600	Sq.Ft.	Negative
12	Room 204	Drywall Tape	14	600	Sq.Ft.	Negative
12	Room 204	Drywall Mud	15	600	Sq.Ft.	Negative
12	**Room 204**	**Fire Door**	**18**	**2**	**Total**	**Assumed**
12	**Room 204**	**Fire Door Frame**	**19**	**1**	**Total**	**Assumed**
12	Room 204	Covebase - Cream	20	30	Sq.Ft.	Negative
12	Room 204	Covebase - Cream Mastic	21	30	Sq.Ft.	Negative
12	Room 204	Door Frame Caulk - Cream	26	21	Ln.Ft.	Negative
12	Room 204	2'x2' Ceiling Tile - Tiny Holes, Small Grooves	30	500	Sq.Ft.	Negative
12	Room 204	Window Frame Glaze - Rubber Black	37	25	Ln.Ft.	Negative

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12	Room 204	Wallpaper Mastic	39	600	Sq.Ft.	Negative
12	Room 204	Covebase - Black	46	45	Sq.Ft.	Negative
12	Room 204	Covebase - Black Mastic	47	45	Sq.Ft.	Negative
12	Room 204	Lab Table	48	40	Sq.Ft.	Negative
12	Room 204	Window Frame Caulk - Cream	49	20	Ln.Ft.	Negative
13	Room 130	Concrete Floor	2	1,200	Sq.Ft.	Negative
13	Room 130	Concrete Wall	3	100	Sq.Ft.	Negative
13	Room 130	Cinderblock	4	800	Sq.Ft.	Negative
13	Room 130	Cinderblock Mortar	5	800	Sq.Ft.	Negative
13	Room 130	Fiberglass Pipe Insulation	6	85	Ln.Ft.	Negative
13	Room 130	Fiberglass Pipe Fitting Insulation	7	10	Ln.Ft.	Negative
13	Room 130	I-Beam and Column Trowell-On	9	30	Sq.Ft.	Negative
13	Room 130	Duct Joint Selant - Cream	10	150	Sq.Ft.	Negative
13	Room 130	Drywall	13	250	Sq.Ft.	Negative
13	Room 130	Drywall Tape	14	250	Sq.Ft.	Negative
13	Room 130	Drywall Mud	15	250	Sq.Ft.	Negative
13	**Room 130**	**Fire Door**	**18**	**2**	**Total**	**Assumed**
13	**Room 130**	**Fire Door Frame**	**19**	**2**	**Total**	**Assumed**
13	Room 130	Brick	24	150	Sq.Ft.	Negative
13	Room 130	Brick Mortar	25	150	Sq.Ft.	Negative
13	Room 130	Door Frame Caulk - Cream	26	17	Ln.Ft.	Negative
13	Room 130	I-Beam Spray-On 2	44	1,200	Sq.Ft.	Negative
13	Room 130	Lab Table	48	36	Sq.Ft.	Negative
13	Room 130	I-Beam Spray-On - Tan	50	1,200	Sq.Ft.	Negative
13	**Room 130**	**Lab Hood**	**51**	**1**	**Total**	**Positive**
13	Room 130	Door Frame Caulk - Black	52	30	Ln.Ft.	Negative
13	Room 130	Window Frame Caulk - Black	53	30	Ln.Ft.	Negative
13	Room 130	Window Frame Glaze - Gray	54	30	Ln.Ft.	Negative
14	Elevator Lobby First Floor	Concrete Deck	1	150	Sq.Ft.	Negative
14	Elevator Lobby First Floor	Concrete Floor	2	150	Sq.Ft.	Negative
14	Elevator Lobby First Floor	Concrete Wall	3	100	Sq.Ft.	Negative
14	Elevator Lobby First Floor	Cinderblock	4	230	Sq.Ft.	Negative
14	Elevator Lobby First Floor	Cinderblock Mortar	5	230	Sq.Ft.	Negative
14	Elevator Lobby First Floor	Fiberglass Pipe Insulation	6	40	Ln.Ft.	Negative
14	Elevator Lobby First Floor	Fiberglass Pipe Fitting Insulation	7	5	Ln.Ft.	Negative
14	Elevator Lobby First Floor	Drywall	13	230	Sq.Ft.	Negative

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14	Elevator Lobby First Floor	Drywall Tape	14	230	Sq.Ft.	Negative
14	Elevator Lobby First Floor	Drywall Mud	15	230	Sq.Ft.	Negative
14	**Elevator Lobby First Floor**	**Fire Door**	**18**	**1**	**Total**	**Assumed**
14	**Elevator Lobby First Floor**	**Fire Door Frame**	**19**	**1**	**Total**	**Assumed**
14	Elevator Lobby First Floor	Door Frame Caulk - Cream	26	17	Ln.Ft.	Negative
14	Elevator Lobby First Floor	Covebase - Rust	28	10	Sq.Ft.	Negative
14	Elevator Lobby First Floor	Covebase - Rust Mastic	29	10	Sq.Ft.	Negative
14	Elevator Lobby First Floor	I-Beam Spray-On 2	44	160	Sq.Ft.	Negative
14	Elevator Lobby First Floor	Cermic Block - Yellow	55	130	Sq.Ft.	Negative
14	Elevator Lobby First Floor	Cermic Block - Yellow Mortar	56	130	Sq.Ft.	Negative
14	Elevator Lobby First Floor	2'x2' Ceiling Panels - Tiny Holes Long Groves	83	4	Sq.Ft.	Negative
15	Hall and Closet	Concrete Deck	1	350	Sq.Ft.	Negative
15	Hall and Closet	Concrete Floor	2	350	Sq.Ft.	Negative
15	Hall and Closet	Cinderblock	4	300	Sq.Ft.	Negative
15	Hall and Closet	Cinderblock Mortar	5	300	Sq.Ft.	Negative
15	Hall and Closet	Fiberglass Pipe Insulation	6	50	Ln.Ft.	Negative
15	Hall and Closet	Fiberglass Pipe Fitting Insulation	7	10	Ln.Ft.	Negative
15	Hall and Closet	Drywall	13	300	Sq.Ft.	Negative
15	Hall and Closet	Drywall Tape	14	300	Sq.Ft.	Negative
15	Hall and Closet	Drywall Mud	15	300	Sq.Ft.	Negative
15	**Hall and Closet**	**Fire Door**	**18**	**2**	**Total**	**Assumed**
15	**Hall and Closet**	**Fire Door Frame**	**19**	**1**	**Total**	**Assumed**
15	Hall and Closet	Brick	24	400	Sq.Ft.	Negative
15	Hall and Closet	Brick Mortar	25	400	Sq.Ft.	Negative
15	Hall and Closet	Covebase - Rust	28	40	Sq.Ft.	Negative
15	Hall and Closet	Covebase - Rust Mastic	29	40	Sq.Ft.	Negative
15	Hall and Closet	2'x2' Ceiling Tile - Tiny Holes, Small Grooves	30	350	Sq.Ft.	Negative
15	Hall and Closet	Batten Insulation - Pink	56	30	Sq.Ft.	Negative
15	Hall and Closet	Duct Joint Selant - Green	57	5	Sq.Ft.	Negative
16	Room 135	Concrete Deck	1	300	Sq.Ft.	Negative
16	Room 135	Concrete Floor	2	300	Sq.Ft.	Negative
16	Room 135	Concrete Wall	3	300	Sq.Ft.	Negative
16	Room 135	Cinderblock	4	500	Sq.Ft.	Negative
16	Room 135	Cinderblock Mortar	5	500	Sq.Ft.	Negative
16	Room 135	Fiberglass Pipe Insulation	6	40	Ln.Ft.	Negative
16	Room 135	Fiberglass Pipe Fitting Insulation	7	7	Ln.Ft.	Negative

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FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
16	Room 135	Concrete Deck Caulk - Tan	12	240	Ln.Ft.	Negative
16	**Room 135**	**Fire Door**	**18**	**2**	**Total**	**Assumed**
16	**Room 135**	**Fire Door Frame**	**19**	**1**	**Total**	**Assumed**
16	Room 135	Door Frame Caulk - Cream	26	20	Ln.Ft.	Negative
17	Hall By Room 34	Concrete Deck	1	300	Sq.Ft.	Negative
17	Hall By Room 34	Concrete Floor	2	300	Sq.Ft.	Negative
17	Hall By Room 34	Concrete Wall	3	300	Sq.Ft.	Negative
17	Hall By Room 34	Cinderblock	4	300	Sq.Ft.	Negative
17	Hall By Room 34	Cinderblock Mortar	5	300	Sq.Ft.	Negative
17	Hall By Room 34	Fiberglass Pipe Insulation	6	105	Ln.Ft.	Negative
17	Hall By Room 34	Fiberglass Pipe Fitting Insulation	7	20	Ln.Ft.	Negative
17	Hall By Room 34	Duct Joint Selant - Cream	10	125	Sq.Ft.	Negative
17	**Hall By Room 34**	**Fire Door**	**18**	**5**	**Total**	**Assumed**
17	**Hall By Room 34**	**Fire Door Frame**	**19**	**3**	**Total**	**Assumed**
17	Hall By Room 34	Door Frame Caulk - Cream	26	65	Ln.Ft.	Negative
18	Room 34	Concrete Floor	2	60	Sq.Ft.	Negative
18	Room 34	Cinderblock	4	200	Sq.Ft.	Negative
18	Room 34	Cinderblock Mortar	5	200	Sq.Ft.	Negative
18	Room 34	Duct Joint Selant - Cream	10	10	Sq.Ft.	Negative
18	Room 34	Drywall	13	60	Sq.Ft.	Negative
18	Room 34	Drywall Tape	14	60	Sq.Ft.	Negative
18	Room 34	Drywall Mud	15	60	Sq.Ft.	Negative
18	Room 34	Door Frame Caulk - Cream	26	18	Ln.Ft.	Negative
19	Fluoride Feed Room	Concrete Deck	1	450	Sq.Ft.	Negative
19	Fluoride Feed Room	Concrete Floor	2	450	Sq.Ft.	Negative
19	Fluoride Feed Room	Concrete Wall	3	350	Sq.Ft.	Negative
19	Fluoride Feed Room	Cinderblock	4	300	Sq.Ft.	Negative
19	Fluoride Feed Room	Cinderblock Mortar	5	300	Sq.Ft.	Negative
19	Fluoride Feed Room	Pipe Gasket	8			Negative
19	Fluoride Feed Room	Duct Joint Selant - Cream	10	75	Sq.Ft.	Negative
19	Fluoride Feed Room	Duct Expansion Joint Fabric - Black	11	4	Sq.Ft.	Negative
19	**Fluoride Feed Room**	**Fire Door**	**18**	**1**	**Total**	**Assumed**
19	**Fluoride Feed Room**	**Fire Door Frame**	**19**	**1**	**Total**	**Assumed**
19	Fluoride Feed Room	Door Frame Caulk - Cream	26	17	Ln.Ft.	Negative
19	Fluoride Feed Room	Plumbers Putty - Red	58	10	Sq.Ft.	Negative
20	Northest Staircase	Concrete Deck	1	400	Sq.Ft.	Negative

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20	Northest Staircase	Concrete Floor	2	150	Sq.Ft.	Negative
20	Northest Staircase	Concrete Wall	3	200	Sq.Ft.	Negative
20	Northest Staircase	Cinderblock	4	400	Sq.Ft.	Negative
20	Northest Staircase	Cinderblock Mortar	5	400	Sq.Ft.	Negative
20	Northest Staircase	Duct Joint Selant - Cream	10	10	Sq.Ft.	Negative
20	**Northest Staircase**	**Fire Door**	**18**	**1**	**Total**	**Assumed**
20	**Northest Staircase**	**Fire Door Frame**	**19**	**1**	**Total**	**Assumed**
20	Northest Staircase	Brick	24	200	Sq.Ft.	Negative
20	Northest Staircase	Brick Mortar	25	200	Sq.Ft.	Negative
20	Northest Staircase	Door Frame Caulk - Cream	26	17	Ln.Ft.	Negative
20	Northest Staircase	2'x2' Ceiling Tile - Tiny Holes, Small Grooves	30	100	Sq.Ft.	Negative
21	Basement	Concrete Deck	1	1,520	Sq.Ft.	Negative
21	Basement	Concrete Floor	2	1,520	Sq.Ft.	Negative
21	Basement	Concrete Wall	3	1,000	Sq.Ft.	Negative
21	Basement	Cinderblock	4	1,000	Sq.Ft.	Negative
21	Basement	Cinderblock Mortar	5	1,000	Sq.Ft.	Negative
21	Basement	Fiberglass Pipe Insulation	6	425	Ln.Ft.	Negative
21	Basement	Fiberglass Pipe Fitting Insulation	7	55	Ln.Ft.	Negative
21	Basement	Pipe Gasket	8			Negative
21	Basement	I-Beam and Column Trowell-On	9	1,000	Sq.Ft.	Negative
21	Basement	Duct Joint Selant - Cream	10	350	Sq.Ft.	Negative
21	Basement	Drywall	13	400	Sq.Ft.	Negative
21	Basement	Drywall Tape	14	400	Sq.Ft.	Negative
21	Basement	Drywall Mud	15	400	Sq.Ft.	Negative
21	**Basement**	**Fire Door**	**18**	**1**	**Total**	**Assumed**
21	**Basement**	**Fire Door Frame**	**19**	**1**	**Total**	**Assumed**
21	Basement	Door Frame Caulk - Cream	26	32	Ln.Ft.	Negative
21	Basement	I-Beam Spray-On 2	44	800	Sq.Ft.	Negative
21	Basement	Plumbers Putty - Red	58	10	Sq.Ft.	Negative
22	Southeast Saircase	Cinderblock	4	5,000	Sq.Ft.	Negative
22	Southeast Saircase	Cinderblock Mortar	5	5,000	Sq.Ft.	Negative
22	Southeast Saircase	Fiberglass Pipe Insulation	6	150	Ln.Ft.	Negative
22	Southeast Saircase	Fiberglass Pipe Fitting Insulation	7	35	Ln.Ft.	Negative
22	**Southeast Saircase**	**Fire Door**	**18**	**4**	**Total**	**Assumed**
22	**Southeast Saircase**	**Fire Door Frame**	**19**	**4**	**Total**	**Assumed**
22	Southeast Saircase	Door Frame Caulk - Cream	26	70	Ln.Ft.	Negative

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22	Southeast Saircase	Step Material - Cream	59	140	Sq.Ft.	Negative
22	Southeast Saircase	Step Material - Cream Mastic	60	140	Sq.Ft.	Negative
22	Southeast Saircase	Step Material - Brown	61	140	Sq.Ft.	Negative
22	Southeast Saircase	Step Material - Brown Mastic	62	140	Sq.Ft.	Negative
22	Southeast Saircase	Window Frame Glaze - Rubber Black 2	63	30	Ln.Ft.	Negative
22	Southeast Saircase	Window Frame Caulk - Black	64	30	Ln.Ft.	Negative
22	Southeast Saircase	12"x12" Floor Tile - Beige with Tan Groves	81	250	Sq.Ft.	Negative
22	Southeast Saircase	12"x12" Floor Tile - Beige with Tan Groves Mastic	82	250	Sq.Ft.	Negative
23	Exterior	Exterior Sandstone Panel 1	65		Sq.Ft.	Negative
23	Exterior	Exterior Sandstone Panel 2	66		Sq.Ft.	Negative
23	Exterior	Exterior Door Frame Caulk - Gray	67		Ln.Ft.	Negative
23	Exterior	Exterior Wall Joint Caulk - Beige	68		Ln.Ft.	Negative
23	Exterior	Exterior Concrete Wall	69		Sq.Ft.	Negative
23	Exterior	Exterior Unpainted Aluminum Windows Caulk - Gray	70	32	Ln.Ft.	Negative
23	Exterior	Exterior Door Frame Caulk - Black	71		Ln.Ft.	Negative
23	Exterior	Exterior Brick	72		Sq.Ft.	Negative
23	Exterior	Exterior Brick Mortar	73		Sq.Ft.	Negative
23	Exterior	Exterior Window Frame Glaze - Black	74		Ln.Ft.	Negative
23	Exterior	Exterior Window Frame Caulk - Black	75		Ln.Ft.	Negative
23	Exterior	Exterior Duct Coating - Gray	76	100	Sq.Ft.	Negative
23	Exterior	Exterior Metal Edge Caulk - Gray	77	100	Ln.Ft.	Negative
23	**Exterior**	**Exterior Window Frame Glaze - Gray**	**78**	**20**	**Ln.Ft.**	**Positive**
23	Exterior	Exterior Old Window Frame Caulk - Black	79	25	Ln.Ft.	Negative
23	Exterior	Exterior Old Window Frame Glaze - Black	80	25	Ln.Ft.	Negative

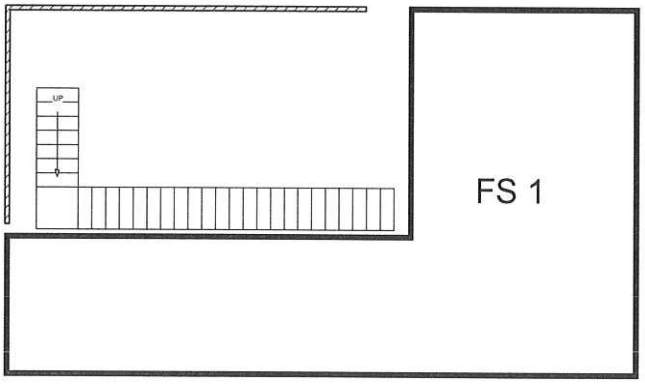
CITY OF ANN ARBOR

WATER TREATMENT PLANT

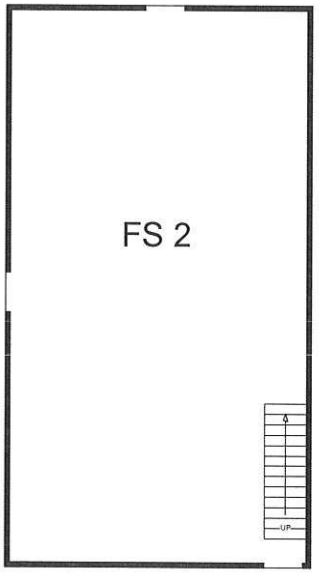
CALCINER BUILDING

FUNCTIONAL SPACES

7TH LEVEL

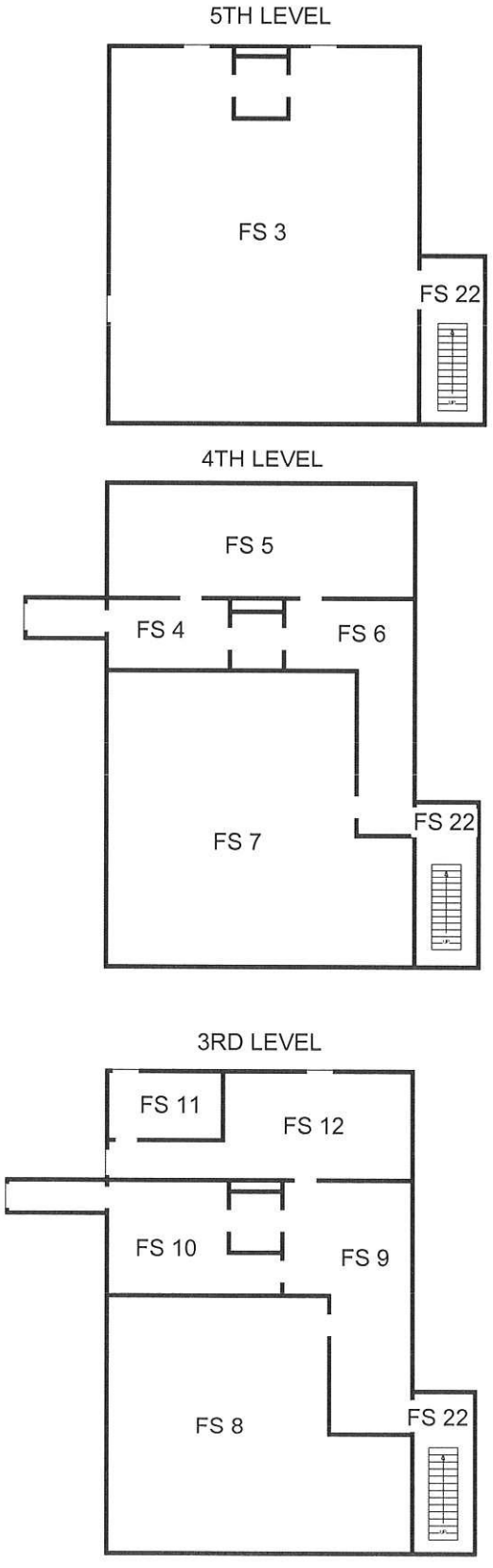


6TH LEVEL



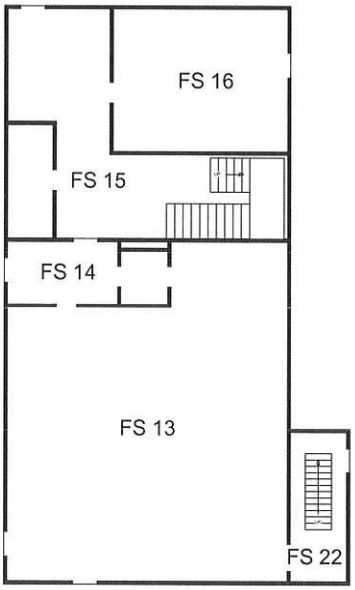
EXTERIOR = FS 23

CITY OF ANN ARBOR
WATER TREATMENT PLANT
CALCINER BUILDING
FUNCTIONAL SPACES



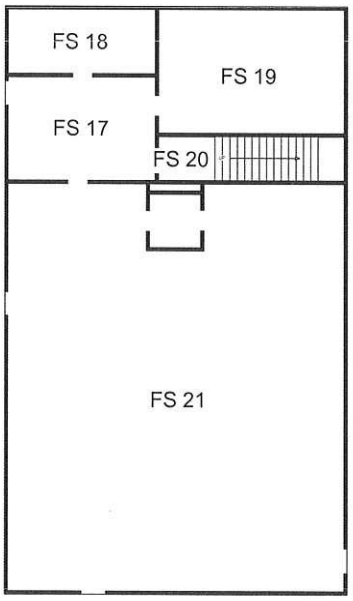
CITY OF ANN ARBOR
WATER TREATMENT PLANT
CALCINER BUILDING
FUNCTIONAL SPACES

2ND LEVEL



LIVING AREA
2816 sq ft

1ST LEVEL



City of Ann Arbor

Water Treatment Plant

1937 Chemical Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
1	Level Six	Brick	2	500	Sq.Ft.	Negative
1	Level Six	Brick Mortar	3	500	Sq.Ft.	Negative
1	Level Six	Metal Deck Caulk - Tan	4	300	Ln.Ft.	Negative
1	**Level Six**	**Pipe Gasket**	**5**			**Assumed**
1	**Level Six**	**Metal Deck Edge Caulk - Gray**	**6**	**120**	**Ln.Ft.**	**Positive**
1	Level Six	Cinderblock	7	2,500	Sq.Ft.	Negative
1	Level Six	Cinderblock Mortar	8	2,500	Sq.Ft.	Negative
1	**Level Six**	**Fire Door**	**9**	**2**	**Total**	**Assumed**
1	**Level Six**	**Fire Door Frame**	**10**	**1**	**Total**	**Assumed**
1	Level Six	Door Frame Caulk - Cream	11	37	Ln.Ft.	Negative
1	Level Six	Window Frame Caulk - Black	12	65	Ln.Ft.	Negative
1	Level Six	Window Glaze - Black	13	65	Ln.Ft.	Negative
1	Level Six	Window Glaze - Rubber Black	14	40	Ln.Ft.	Negative
1	Level Six	Window Glaze - Clear	15	30	Ln.Ft.	Negative
1	Level Six	Old Door Window Glaze - Cream	16	15	Ln.Ft.	Negative
1	Level Six	Concrete Deck	21	1,200	Sq.Ft.	Negative
1	Level Six	Concrete Floor	23	1,093	Sq.Ft.	Negative
2	Level Five	Brick	2	1,000	Sq.Ft.	Negative
2	Level Five	Brick Mortar	3	1,000	Sq.Ft.	Negative
2	**Level Five**	**Pipe Gasket**	**5**			**Assumed**
2	Level Five	Cinderblock	7	3,000	Sq.Ft.	Negative
2	Level Five	Cinderblock Mortar	8	3,000	Sq.Ft.	Negative
2	**Level Five**	**Fire Door**	**9**	**3**	**Total**	**Assumed**
2	**Level Five**	**Fire Door Frame**	**10**	**2**	**Total**	**Assumed**
2	Level Five	Door Frame Caulk - Cream	11	36	Ln.Ft.	Negative
2	Level Five	Fiberglass Pipe Insulation	17	750	Ln.Ft.	Negative
2	Level Five	Fiberglass Pipe Fitting Insulation	18	85	Ln.Ft.	Negative
2	Level Five	Exhaust Duct Caulk - Red	19	3	Sq.Ft.	Negative
2	Level Five	Expansion Joint Fabric - Black	20	8	Ln.Ft.	Negative
2	Level Five	Concrete Deck	21	1,200	Sq.Ft.	Negative
2	Level Five	Concrete Walls	22	3,000	Sq.Ft.	Negative
2	Level Five	Concrete Floor	23	1,200	Sq.Ft.	Negative
2	Level Five	Plumbers Putty - Red	24	4	Sq.Ft.	Negative
2	Level Five	Boiler Fiberglass Insulation	25	200	Sq.Ft.	Negative
2	Level Five	Boiler Fiberglass Pad Insulation with Aluminum	26	80	Sq.Ft.	Negative
2	Level Five	Window Frame Caulk - Black 2	30	275	Ln.Ft.	Negative

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
3	Level Four	Brick	2	300	Sq.Ft.	Negative
3	Level Four	Brick Mortar	3	300	Sq.Ft.	Negative
3	**Level Four**	**Pipe Gasket**	**5**			**Assumed**
3	Level Four	Cinderblock	7	1,700	Sq.Ft.	Negative
3	Level Four	Cinderblock Mortar	8	1,700	Sq.Ft.	Negative
3	Level Four	Window Frame Caulk - Black	12	100	Ln.Ft.	Negative
3	Level Four	Window Glaze - Rubber Black	14	40	Ln.Ft.	Negative
3	Level Four	Fiberglass Pipe Insulation	17	40	Ln.Ft.	Negative
3	Level Four	Concrete Deck	21	1,500	Sq.Ft.	Negative
3	Level Four	Concrete Walls	22	1,600	Sq.Ft.	Negative
3	Level Four	Concrete Floor	23	1,500	Sq.Ft.	Negative
3	Level Four	Plumbers Putty - Red	24	5	Sq.Ft.	Negative
3	Level Four	Window Glaze - Gray	27	100	Ln.Ft.	Negative
3	Level Four	Ceramic Block - Yellow	28	1,200	Sq.Ft.	Negative
3	Level Four	Ceramic Block Mortar	29	1,200	Sq.Ft.	Negative
3	Level Four	Yellow Brick	31	1,000	Sq.Ft.	Negative
3	Level Four	Yellow Brick Mortar	32	1,000	Sq.Ft.	Negative
3	Level Four	Hopper Caulk - White	33	24	Ln.Ft.	Negative
3	Level Four	Smooth Plaster Finish Coat on Concrete	34	100	Sq.Ft.	Negative
4	**Room 123**	**Pipe Gasket**	**5**			**Assumed**
4	**Room 123**	**Fire Door**	**9**	**3**	**Total**	**Assumed**
4	Room 123	Window Frame Caulk - Black	12	45	Ln.Ft.	Negative
4	Room 123	Window Glaze - Rubber Black	14	60	Ln.Ft.	Negative
4	Room 123	Fiberglass Pipe Insulation	17	180	Ln.Ft.	Negative
4	Room 123	Fiberglass Pipe Fitting Insulation	18	16	Ln.Ft.	Negative
4	Room 123	Concrete Deck	21	1,320	Sq.Ft.	Negative
4	Room 123	Concrete Walls	22	350	Sq.Ft.	Negative
4	Room 123	Concrete Floor	23	1,320	Sq.Ft.	Negative
4	Room 123	Ceramic Block - Yellow	28	1,300	Sq.Ft.	Negative
4	Room 123	Ceramic Block Mortar	29	1,300	Sq.Ft.	Negative
4	Room 123	Door Frame Caulk - Black	35		Ln.Ft.	Negative
5	Room 128	Plumbers Putty - Blue	1	2	Sq.Ft.	Negative
5	Room 128	Cinderblock	7	500	Sq.Ft.	Negative
5	Room 128	Cinderblock Mortar	8	500	Sq.Ft.	Negative
5	**Room 128**	**Fire Door**	**9**	**2**	**Total**	**Assumed**
5	**Room 128**	**Fire Door Frame**	**10**	**2**	**Total**	**Assumed**

City of Ann Arbor

Water Treatment Plant

1937 Chemical Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
5	Room 128	Door Frame Caulk - Cream	11	16	Ln.Ft.	Negative
5	Room 128	Fiberglass Pipe Insulation	17	15	Ln.Ft.	Negative
5	Room 128	Fiberglass Pipe Fitting Insulation	18	8	Ln.Ft.	Negative
5	Room 128	Concrete Deck	21	300	Sq.Ft.	Negative
5	Room 128	Concrete Walls	22	800	Sq.Ft.	Negative
5	Room 128	Concrete Floor	23	945	Sq.Ft.	Negative
5	Room 128	Ceramic Block - Yellow	28	1,500	Sq.Ft.	Negative
5	Room 128	Ceramic Block Mortar	29	1,500	Sq.Ft.	Negative
5	Room 128	Deck Packing Material	35	20	Sq.Ft.	Negative
6	Storage Room 129	Brick	2	225	Sq.Ft.	Negative
6	Storage Room 129	Brick Mortar	3	225	Sq.Ft.	Negative
6	Storage Room 129	Cinderblock	7	100	Sq.Ft.	Negative
6	Storage Room 129	Cinderblock Mortar	8	100	Sq.Ft.	Negative
6	Storage Room 129	Window Frame Caulk - Black	12	20	Ln.Ft.	Negative
6	Storage Room 129	Window Glaze - Rubber Black	14	24	Ln.Ft.	Negative
6	Storage Room 129	Concrete Deck	21	100	Sq.Ft.	Negative
6	Storage Room 129	Concrete Floor	23	150	Sq.Ft.	Negative
7	West Restroom	Door Frame Caulk - Cream	11	7	Ln.Ft.	Negative
7	West Restroom	Ceramic Block - Yellow	28	225	Sq.Ft.	Negative
7	West Restroom	Ceramic Block Mortar	29	225	Sq.Ft.	Negative
7	West Restroom	Smooth Plaster Finish Coat	36	81	Sq.Ft.	Negative
7	West Restroom	Smooth Plaster Brown Coat	37	81	Sq.Ft.	Negative
8	Room 120	Fiberglass Pipe Insulation	17	20	Ln.Ft.	Negative
8	Room 120	Concrete Deck	21	276	Sq.Ft.	Negative
8	Room 120	2'x2' Ceiling Panels - Light Bumpy	38	276	Sq.Ft.	Negative
8	Room 120	Drywall	39	680	Sq.Ft.	Negative
8	Room 120	Drywall Tape	40	680	Sq.Ft.	Negative
8	Room 120	Drywall Mud	41	680	Sq.Ft.	Negative
8	Room 120	Covebase - Rust	42	60	Ln.Ft.	Negative
8	Room 120	Covebase Mastic	43	60	Ln.Ft.	Negative
8	Room 120	Fiberglass Duct Insulation with Foil	44	35	Sq.Ft.	Negative
8	Room 120	Wall Paper Mastic	45	480	Sq.Ft.	Negative
9	Maintenance Supervisior Room	Fiberglass Pipe Insulation	17	50	Ln.Ft.	Negative
9	Maintenance Supervisior Room	Fiberglass Pipe Fitting Insulation	18	12	Ln.Ft.	Negative
9	Maintenance Supervisior Room	Concrete Deck	21	200	Sq.Ft.	Negative
9	Maintenance Supervisior Room	2'x2' Ceiling Panels - Light Bumpy	38	200	Sq.Ft.	Negative

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
9	Maintenance Supervisior Room	Drywall	39	900	Sq.Ft.	Negative
9	Maintenance Supervisior Room	Drywall Tape	40	900	Sq.Ft.	Negative
9	Maintenance Supervisior Room	Drywall Mud	41	900	Sq.Ft.	Negative
9	Maintenance Supervisior Room	Covebase - Rust	42	65	Ln.Ft.	Negative
9	Maintenance Supervisior Room	Covebase Mastic	43	65	Ln.Ft.	Negative
9	Maintenance Supervisior Room	Fiberglass Duct Insulation with Foil	44	30	Sq.Ft.	Negative
9	Maintenance Supervisior Room	Wall Paper Mastic	45	500	Sq.Ft.	Negative
9	Maintenance Supervisior Room	Duct Joint Sealant - Green	46	1	Ln.Ft.	Negative
9	Maintenance Supervisior Room	12"x12" Floor Tile - Tan with Beige Specs.	47	200	Sq.Ft.	Negative
9	Maintenance Supervisior Room	12"x12" Floor Tile - Tan with Beige Specs. Mastic	48	200	Sq.Ft.	Negative
10	Room 125	Door Frame Caulk - Cream	11	21	Ln.Ft.	Negative
10	Room 125	Ceramic Block - Yellow	28	250	Sq.Ft.	Negative
10	Room 125	Ceramic Block Mortar	29	250	Sq.Ft.	Negative
10	Room 125	Smooth Plaster Finish Coat	36	120	Sq.Ft.	Negative
10	Room 125	Smooth Plaster Brown Coat	37	120	Sq.Ft.	Negative
10	Room 125	Drywall	39	175	Sq.Ft.	Negative
10	Room 125	Drywall Tape	40	175	Sq.Ft.	Negative
10	Room 125	Drywall Mud	41	175	Sq.Ft.	Negative
10	Room 125	2'x2' Ceiling Panels -Tiny Holes Small Groves	49	120	Sq.Ft.	Negative
11	**Halls**	**Fire Door**	**9**	**3**	**Total**	**Assumed**
11	**Halls**	**Fire Door Frame**	**10**	**3**	**Total**	**Assumed**
11	Halls	Door Frame Caulk - Cream	11	100	Ln.Ft.	Negative
11	Halls	Fiberglass Pipe Insulation	17	235	Ln.Ft.	Negative
11	Halls	Fiberglass Pipe Fitting Insulation	18	12	Ln.Ft.	Negative
11	Halls	Concrete Deck	21	1,295	Sq.Ft.	Negative
11	Halls	Ceramic Block - Yellow	28	1,050	Sq.Ft.	Negative
11	Halls	Ceramic Block Mortar	29	1,050	Sq.Ft.	Negative
11	Halls	Smooth Plaster Finish Coat	36	750	Sq.Ft.	Negative
11	Halls	Smooth Plaster Brown Coat	37	750	Sq.Ft.	Negative
11	Halls	Drywall	39	1,700	Sq.Ft.	Negative
11	Halls	Drywall Tape	40	1,700	Sq.Ft.	Negative
11	Halls	Drywall Mud	41	1,700	Sq.Ft.	Negative
11	Halls	Covebase - Rust	42	245	Ln.Ft.	Negative
11	Halls	Covebase Mastic	43	245	Ln.Ft.	Negative
11	Halls	Fiberglass Duct Insulation with Foil	44	940	Ln.Ft.	Negative
11	Halls	Wall Paper Mastic	45	1,300	Sq.Ft.	Negative

City of Ann Arbor

Water Treatment Plant

1937 Chemical Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
14	Room 116	Brick	2	250	Sq.Ft.	Negative
14	Room 116	Brick Mortar	3	250	Sq.Ft.	Negative
14	Room 116	Cinderblock	7	250	Sq.Ft.	Negative
14	Room 116	Cinderblock Mortar	8	250	Sq.Ft.	Negative
14	Room 116	Fiberglass Pipe Insulation	17	40	Ln.Ft.	Negative
14	Room 116	Concrete Deck	21	150	Sq.Ft.	Negative
14	Room 116	Smooth Plaster Finish Coat	36	150	Sq.Ft.	Negative
14	Room 116	Smooth Plaster Brown Coat	37	150	Sq.Ft.	Negative
14	Room 116	Drywall	39	350	Sq.Ft.	Negative
14	Room 116	Drywall Tape	40	350	Sq.Ft.	Negative
14	Room 116	Drywall Mud	41	350	Sq.Ft.	Negative
14	Room 116	Fiberglass Duct Insulation with Foil	44	75	Sq.Ft.	Negative
14	Room 116	Duct Joint Sealant - Cream	50	6	Ln.Ft.	Negative
14	Room 116	Batten Insulation - Yellow	63	150	Sq.Ft.	Negative
15	Men's Restroom	Brick	2	100	Sq.Ft.	Negative
15	Men's Restroom	Brick Mortar	3	100	Sq.Ft.	Negative
15	Men's Restroom	Fiberglass Pipe Insulation	17	85	Ln.Ft.	Negative
15	Men's Restroom	Fiberglass Pipe Fitting Insulation	18	15	Ln.Ft.	Negative
15	Men's Restroom	Concrete Deck	21	300	Sq.Ft.	Negative
15	Men's Restroom	Ceramic Block - Yellow	28	150	Sq.Ft.	Negative
15	Men's Restroom	Ceramic Block Mortar	29	150	Sq.Ft.	Negative
15	Men's Restroom	Smooth Plaster Finish Coat	36	300	Sq.Ft.	Negative
15	Men's Restroom	Smooth Plaster Brown Coat	37	300	Sq.Ft.	Negative
15	Men's Restroom	Drywall	39	250	Sq.Ft.	Negative
15	Men's Restroom	Drywall Tape	40	250	Sq.Ft.	Negative
15	Men's Restroom	Drywall Mud	41	250	Sq.Ft.	Negative
15	Men's Restroom	Fiberglass Duct Insulation with Foil	44	75	Sq.Ft.	Negative
15	Men's Restroom	Duct Joint Sealant - Green	46	10	Ln.Ft.	Negative
15	Men's Restroom	Duct Joint Sealant - Cream	50	75	Ln.Ft.	Negative
15	Men's Restroom	Ceiling Edge Caulk - White	62	55	Ln.Ft.	Negative
15	**Men's Restroom**	**Aircell Pipe Insulation**	**64**	**25**	**Ln.Ft.**	**Assumed**
15	**Men's Restroom**	**Mud Fitting**	**65**	**1**	**Ln.Ft.**	**Assumed**
16	Room 114	Fiberglass Pipe Insulation	17	350	Ln.Ft.	Negative
16	Room 114	Fiberglass Pipe Fitting Insulation	18	60	Ln.Ft.	Negative
16	Room 114	Concrete Deck	21	900	Sq.Ft.	Negative
16	Room 114	Drywall	39	1,500	Sq.Ft.	Negative

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
16	Room 114	Drywall Tape	40	1,500	Sq.Ft.	Negative
16	Room 114	Drywall Mud	41	1,500	Sq.Ft.	Negative
16	Room 114	Fiberglass Duct Insulation with Foil	44	450	Sq.Ft.	Negative
16	Room 114	Wall Paper Mastic	45	750	Sq.Ft.	Negative
16	Room 114	Duct Joint Sealant - Green	46	50	Ln.Ft.	Negative
16	Room 114	Duct Joint Sealant - Cream	50	50	Ln.Ft.	Negative
16	Room 114	Covebase - Cream	53	75	Ln.Ft.	Negative
16	Room 114	Covebase - Cream Mastic	54	75	Ln.Ft.	Negative
16	Room 114	12"x12" Floor Tile - White with Beige Specs	66	835	Sq.Ft.	Negative
16	Room 114	12"x12" Floor Tile - White with Beige Specs Mastic	67	835	Sq.Ft.	Negative
16	Room 114	12"x12" Floor Tile - Blue with Light Blue Specs	68	65	Sq.Ft.	Negative
16	Room 114	12"x12" Floor Tile - Blue with Light Blue Specs Mastic	69	65	Sq.Ft.	Negative
16	Room 114	2'x2' Ceiling Panels - Flat	70	900	Sq.Ft.	Negative
16	Room 114	Lab Counter 1	71	24	Sq.Ft.	Negative
16	Room 114	Lab Counter 2	72	400	Sq.Ft.	Negative
16	Room 114	Lab Rack	73	27	Sq.Ft.	Negative
16	Room 114	Duct Joint Sealant - Gray	74	50	Ln.Ft.	Negative
17	Room Near 25/26	Cinderblock	7	300	Sq.Ft.	Negative
17	Room Near 25/26	Cinderblock Mortar	8	300	Sq.Ft.	Negative
17	**Room Near 25/26**	**Fire Door**	**9**	**3**	**Total**	**Assumed**
17	**Room Near 25/26**	**Fire Door Frame**	**10**	**1**	**Total**	**Assumed**
17	Room Near 25/26	Door Frame Caulk - Cream	11	90	Ln.Ft.	Negative
17	Room Near 25/26	Fiberglass Pipe Insulation	17	120	Ln.Ft.	Negative
17	Room Near 25/26	Fiberglass Pipe Fitting Insulation	18	12	Ln.Ft.	Negative
17	Room Near 25/26	Concrete Deck	21	441	Sq.Ft.	Negative
17	Room Near 25/26	Concrete Walls	22	300	Sq.Ft.	Negative
17	Room Near 25/26	Concrete Floor	23	441	Sq.Ft.	Negative
17	Room Near 25/26	Duct Joint Sealant - Cream	50	20	Ln.Ft.	Negative
18	Room 26	Cinderblock	7	200	Sq.Ft.	Negative
18	Room 26	Cinderblock Mortar	8	200	Sq.Ft.	Negative
18	Room 26	Concrete Deck	21	120	Sq.Ft.	Negative
18	Room 26	Concrete Walls	22	200	Sq.Ft.	Negative
18	Room 26	Concrete Floor	23	120	Sq.Ft.	Negative
19	Room 25	Cinderblock	7	300	Sq.Ft.	Negative
19	Room 25	Cinderblock Mortar	8	300	Sq.Ft.	Negative
19	Room 25	Concrete Deck	21	150	Sq.Ft.	Negative

City of Ann Arbor

Water Treatment Plant

1937 Chemical Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
19	Room 25	Concrete Walls	22	300	Sq.Ft.	Negative
19	Room 25	Concrete Floor	23	150	Sq.Ft.	Negative
20	**Room 33**	**Pipe Gasket**	**5**			**Assumed**
20	Room 33	Cinderblock	7	400	Sq.Ft.	Negative
20	Room 33	Cinderblock Mortar	8	400	Sq.Ft.	Negative
20	Room 33	Door Frame Caulk - Cream	11	40	Ln.Ft.	Negative
20	Room 33	Fiberglass Pipe Insulation	17	330	Ln.Ft.	Negative
20	Room 33	Fiberglass Pipe Fitting Insulation	18	30	Ln.Ft.	Negative
20	Room 33	Concrete Deck	21	860	Sq.Ft.	Negative
20	Room 33	Concrete Walls	22	900	Sq.Ft.	Negative
20	Room 33	Concrete Floor	23	860	Sq.Ft.	Negative
21	Level Two South	Brick	2	250	Sq.Ft.	Negative
21	Level Two South	Brick Mortar	3	250	Sq.Ft.	Negative
21	**Level Two South**	**Pipe Gasket**	**5**			**Assumed**
21	Level Two South	Cinderblock	7	300	Sq.Ft.	Negative
21	Level Two South	Cinderblock Mortar	8	300	Sq.Ft.	Negative
21	**Level Two South**	**Fire Door**	**9**	**2**	**Total**	**Assumed**
21	**Level Two South**	**Fire Door Frame**	**10**	**1**	**Total**	**Assumed**
21	Level Two South	Door Frame Caulk - Cream	11	21	Ln.Ft.	Negative
21	Level Two South	Fiberglass Pipe Insulation	17	600	Ln.Ft.	Negative
21	Level Two South	Fiberglass Pipe Fitting Insulation	18	60	Ln.Ft.	Negative
21	Level Two South	Concrete Deck	21	1,400	Sq.Ft.	Negative
21	Level Two South	Concrete Walls	22	1,000	Sq.Ft.	Negative
21	Level Two South	Concrete Floor	23	1,400	Sq.Ft.	Negative
21	Level Two South	Ceramic Block - Yellow	28	250	Sq.Ft.	Negative
21	Level Two South	Ceramic Block Mortar	29	250	Sq.Ft.	Negative
21	Level Two South	Large Pipe Wrap	75	140	Sq.Ft.	Negative
21	Level Two South	Large Pipe Wrap Coating	76	140	Sq.Ft.	Negative
22	**Level Two Center**	**Pipe Gasket**	**5**			**Assumed**
22	Level Two Center	Cinderblock	7	250	Sq.Ft.	Negative
22	Level Two Center	Cinderblock Mortar	8	250	Sq.Ft.	Negative
22	**Level Two Center**	**Fire Door**	**9**	**2**	**Total**	**Assumed**
22	**Level Two Center**	**Fire Door Frame**	**10**	**2**	**Total**	**Assumed**
22	Level Two Center	Door Frame Caulk - Cream	11	70	Ln.Ft.	Negative
22	Level Two Center	Fiberglass Pipe Insulation	17	600	Ln.Ft.	Negative
22	Level Two Center	Fiberglass Pipe Fitting Insulation	18	45	Ln.Ft.	Negative

City of Ann Arbor

Water Treatment Plant

1937 Chemical Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
22	Level Two Center	Concrete Deck	21	1,849	Sq.Ft.	Negative
22	Level Two Center	Concrete Walls	22	1,600	Sq.Ft.	Negative
22	Level Two Center	Ceramic Block - Yellow	28	250	Sq.Ft.	Negative
22	Level Two Center	Ceramic Block Mortar	29	250	Sq.Ft.	Negative
22	Level Two Center	Plumbers Putty - Gray	77	1	Ln.Ft.	Negative
22	Level Two Center	Duct Expansion Fabric - Gray	78	4	Sq.Ft.	Negative
23	**Level Two North**	**Pipe Gasket**	**5**			**Assumed**
23	**Level Two North**	**Fire Door**	**9**	**2**	**Total**	**Assumed**
23	**Level Two North**	**Fire Door Frame**	**10**	**1**	**Total**	**Assumed**
23	Level Two North	Door Frame Caulk - Cream	11	24	Ln.Ft.	Negative
23	Level Two North	Fiberglass Pipe Insulation	17	450	Ln.Ft.	Negative
23	Level Two North	Fiberglass Pipe Fitting Insulation	18	50	Ln.Ft.	Negative
23	Level Two North	Expansion Joint Fabric - Black	20	4	Sq.Ft.	Negative
23	Level Two North	Concrete Deck	21	1,625	Sq.Ft.	Negative
23	Level Two North	Concrete Walls	22	2,000	Sq.Ft.	Negative
24	**Level One North**	**Pipe Gasket**	**5**			**Assumed**
24	Level One North	Concrete Deck	21	1,125	Sq.Ft.	Negative
24	Level One North	Concrete Walls	22	1,700	Sq.Ft.	Negative
24	Level One North	Concrete Floor	23	1,125	Sq.Ft.	Negative
25	**Level One Center**	**Pipe Gasket**	**5**			**Assumed**
25	Level One Center	Concrete Deck	21	700	Sq.Ft.	Negative
25	Level One Center	Concrete Walls	22	1,200	Sq.Ft.	Negative
25	Level One Center	Concrete Floor	23	900	Sq.Ft.	Negative
26	Level One South	No Access				
27	Exterior	Exterior Brick - Red	79	6,900	Sq.Ft.	Negative
27	Exterior	Exterior Brick - Red Mortar	80	6,900	Sq.Ft.	Negative
27	Exterior	Exterior Door Frame Caulk - Gray	81	40	Ln.Ft.	Negative
27	Exterior	Exterior Window Frame Caulk - Gray	82	178	Ln.Ft.	Negative
27	Exterior	Exterior Window Frame Caulk - Black	83	16	Ln.Ft.	Negative
27	Exterior	Exterior Window Frame Caulk - Black 2	84	170	Ln.Ft.	Negative
27	**Exterior**	**Exterior Window Frame Glaze - Black**	**85**	**372**	**Ln.Ft.**	**Positive**
27	Exterior	Exterior Window Frame Glaze - Rubber Black	86	24	Ln.Ft.	Negative
27	Exterior	Exterior Wall Joint Caulk - Gray	87	165	Ln.Ft.	Negative
27	Exterior	Exterior Wall Joint Caulk - Beige	88	240	Ln.Ft.	Negative
27	Exterior	Exterior Wall Joint Caulk - Cream	89	130	Ln.Ft.	Negative
27	**Exterior**	**Exterior Sill Caulk - Cream**	**90**	**48**	**Ln.Ft.**	**Positive**

City of Ann Arbor

Water Treatment Plant

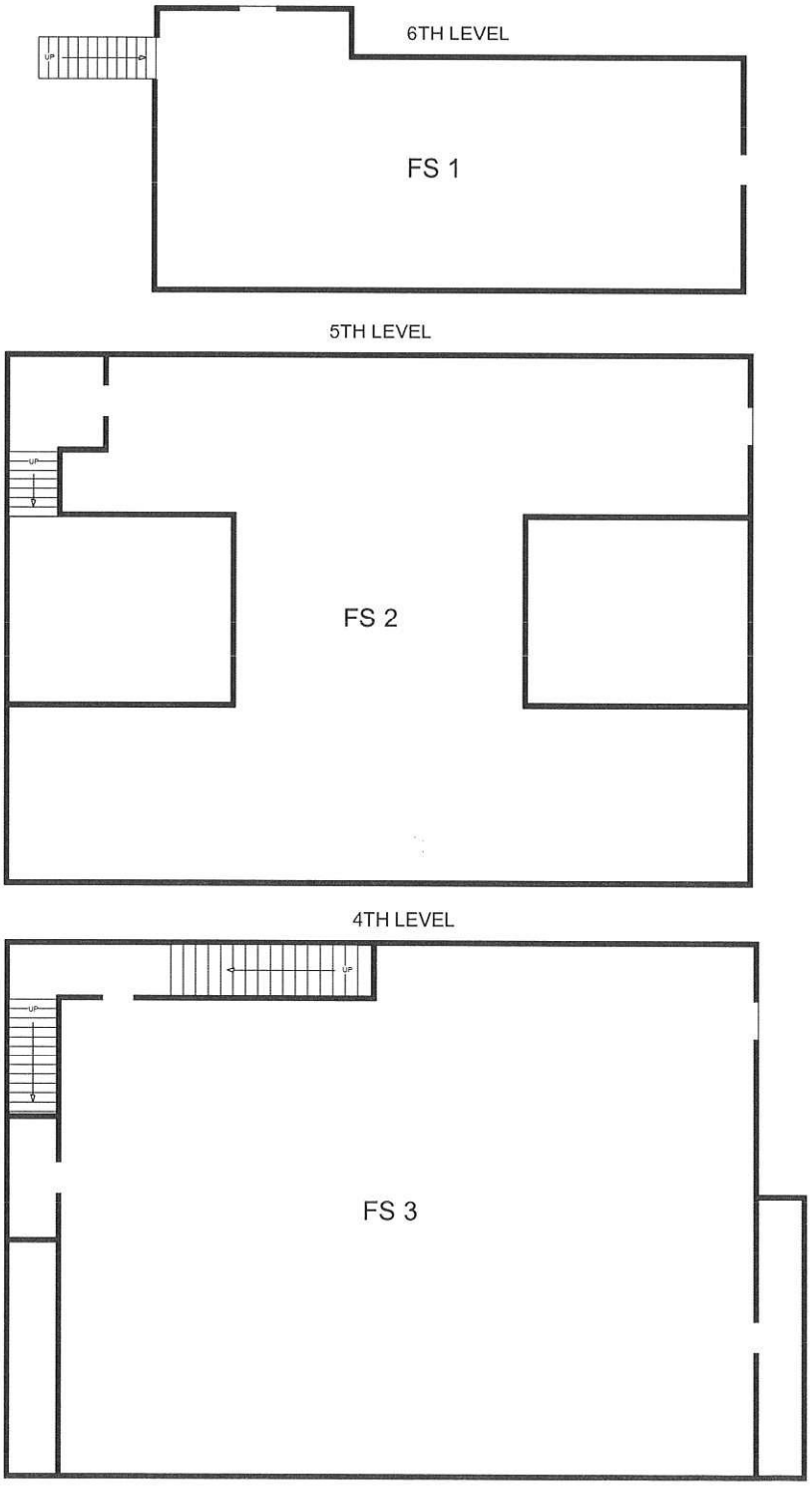
1937 Chemical Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
27	**Exterior**	**Exterior Lintel Caulk - Cream**	**91**	**66**	**Ln.Ft.**	**Positive**
27	Exterior	Exterior Sandstone	92	1,080	Sq.Ft.	Negative
27	Exterior	Exterior Sandstone Mortar	93	1,080	Sq.Ft.	Negative
27	Exterior	Exterior Louver Caulk - Gray	94	16	Ln.Ft.	Negative
27	Exterior	Exterior Sandstone Cap Caulk - Cream	95	163	Ln.Ft.	Negative
27	Exterior	Exterior Skylight Glaze - Black	96	150	Ln.Ft.	Negative
27	Exterior	Exterior Skylight Seam Caulk - Brown	97	50	Ln.Ft.	Negative
27	Exterior	Exterior Duct Expansion Fabric - Black	98	4	Sq.Ft.	Negative
27	Exterior	Exterior Duct Joint Sealant - White	99	8	Ln.Ft.	Negative
27	Exterior	Roof Top Unit (East of Skylight) Caulk - Gray	100	150	Ln.Ft.	Negative
27	Exterior	Roof Top Unit (East of Skylight) Caulk - Clear	101	150	Ln.Ft.	Negative
27	Exterior	Roof Edge Caulk - Gray	102	20	Ln.Ft.	Negative
27	Exterior	Exterior Exhaust Pipe Caulk - Gray	104	3	Ln.Ft.	Negative

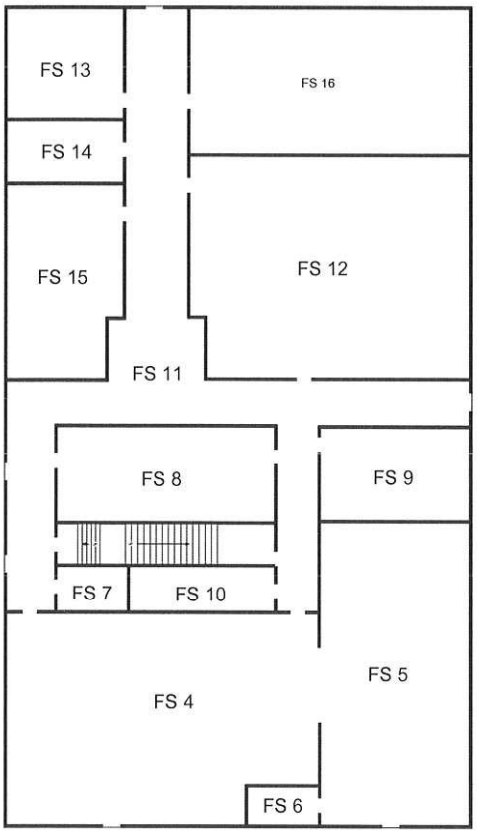
CITY OF ANN ARBOR
WATER TREATMENT PLANT
CHEMICAL BUILDING
FUNCTIONAL SPACES

EXTERIOR = FS 27

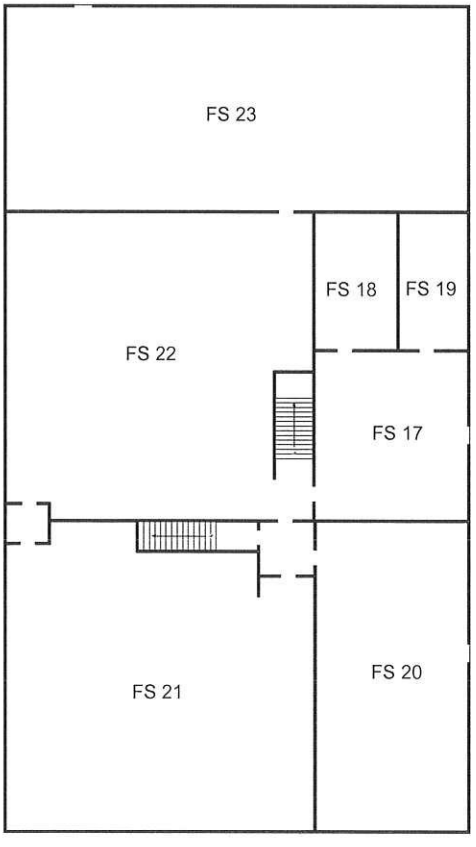


CITY OF ANN ARBOR
WATER TREATMENT PLANT
CHEMICAL BUILDING
FUNCTIONAL SPACES

3RD LEVEL



2ND LEVEL



FS 24 & 25 NOT ON MAP
FS 26 NO ACCESS

City of Ann Arbor

Water Treatment Plant

Filter Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
1	Second Level	Concrete Deck	1	12,500	Sq.Ft.	Negative
1	Second Level	Concrete Deck Caulk - Cream	2	2,900	Ln.Ft.	Negative
1	**Second Level**	**Fire Door**	**3**	**3**	**Total**	**Assumed**
1	Second Level	Door Frame Caulk - Brown	4	18	Ln.Ft.	Negative
1	Second Level	Window Frame Caulk - Brown	5	640	Ln.Ft.	Negative
1	Second Level	Window Glaze - Black Rubber	6	475	Ln.Ft.	Negative
1	Second Level	Ceramic Block Wall - Peach	7	5,000	Sq.Ft.	Negative
1	Second Level	Ceramic Block Wall Mortar	8	5,000	Sq.Ft.	Negative
1	Second Level	Smooth Plaster Wall	9	250	Sq.Ft.	Negative
1	Second Level	Concrete Floor	10	14,400	Sq.Ft.	Negative
1	Second Level	Duct Expansion Fabric - Black	11	12	Sq.Ft.	Negative
1	Second Level	Concrete Wall	12	25,000	Sq.Ft.	Negative
1	Second Level	Fiberglass Pipe Insulation	13	850	Ln.Ft.	Negative
1	Second Level	Fiberglass Pipe Fitting Insulation	14	75	Ln.Ft.	Negative
1	**Second Level**	**Fire Door Frame**	**15**	**1**	**Total**	**Assumed**
1	Second Level	Door Frame Caulk - Gray	16	21	Ln.Ft.	Negative
1	Second Level	Door Frame Caulk - Cream	17	72	Ln.Ft.	Negative
1	**Second Level**	**Window Frame Caulk - Tan**	**18**	**745**	**Ln.Ft.**	**Positive**
1	Second Level	Window Glaze - Cream	19	775	Ln.Ft.	Negative
1	Second Level	Window Frame Caulk - Black	20	715	Ln.Ft.	Negative
1	Second Level	Wall Joint Caulk - Gray	21	350	Ln.Ft.	Negative
1	Second Level	Cinderblock	22	4,000	Sq.Ft.	Negative
1	Second Level	Cinderblock Mortar	23	4,000	Sq.Ft.	Negative
1	Second Level	Concrete Deck 2	24	7,680	Sq.Ft.	Negative
1	Second Level	Brick - Red	25	400	Sq.Ft.	Negative
1	Second Level	Brick Mortar	26	400	Sq.Ft.	Negative
1	Second Level	Step Pads	27	60	Sq.Ft.	Negative
1	**Second Level**	**Pipe Gasket**	**28**			**Assumed**
2	First Level	Concrete Deck	1	7,000	Sq.Ft.	Negative
2	First Level	Concrete Floor	10	7,000	Sq.Ft.	Negative
2	First Level	Concrete Wall	12	12,300	Sq.Ft.	Negative
2	First Level	Fiberglass Pipe Insulation	13	1,500	Ln.Ft.	Negative
2	First Level	Fiberglass Pipe Fitting Insulation	14	100	Ln.Ft.	Negative
2	First Level	Brick Mortar	26	300	Sq.Ft.	Negative
2	**First Level**	**Pipe Gasket**	**28**			**Assumed**
2	First Level	Wall Joint Caulk - Black	29	15	Ln.Ft.	Negative
2	**First Level**	**Mud Fitting**	**30**	**30**	**Ln.Ft.**	**Assumed**
2	First Level	Brick - Gray	31	300	Sq.Ft.	Negative

City of Ann Arbor

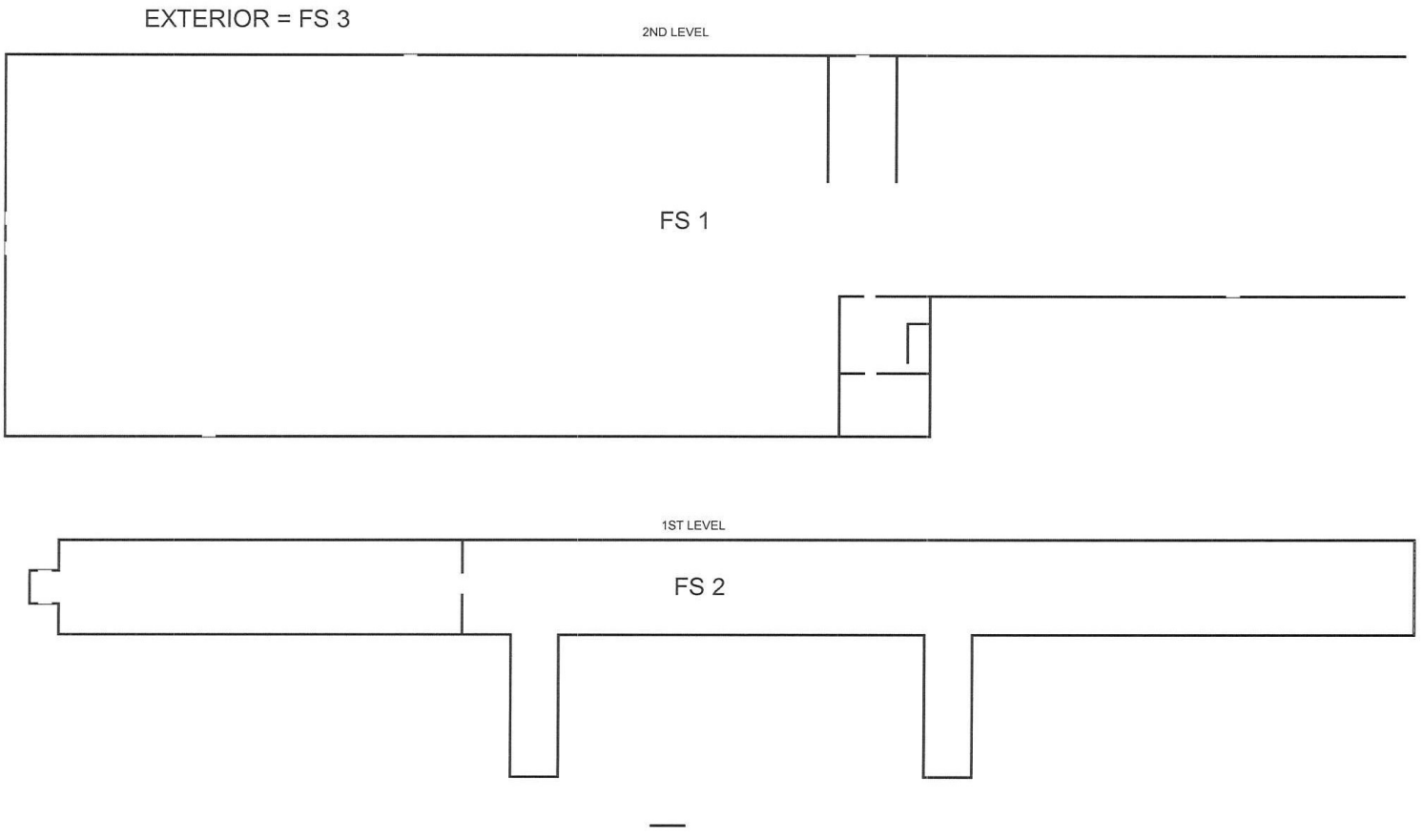
Water Treatment Plant

Filter Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
2	First Level	Large Pipe Wrap	32	80	Ln.Ft.	Negative
2	First Level	Large Pipe Wrap Black Coating	33	80	Ln.Ft.	Negative
3	Exterior	Exterior Sandstone Block	34	1,110	Sq.Ft.	Negative
3	Exterior	Exterior Sandstone Block Mortar	35	1,110	Sq.Ft.	Negative
3	Exterior	Exterior Concrete Caulk - Cream	36	200	Ln.Ft.	Negative
3	Exterior	Exterior Wall Joint Caulk - Beige	37	50	Ln.Ft.	Negative
3	Exterior	Exterior Window Frame Caulk - Black	38	420	Ln.Ft.	Negative
3	**Exterior**	**Exterior Window Glaze - Black**	**39**	**213**	**Ln.Ft.**	**Positive**
3	Exterior	Exterior Concrete Wall	40	1,200	Sq.Ft.	Negative
3	Exterior	Exterior Brick - Red	41	5,700	Sq.Ft.	Negative
3	Exterior	Exterior Brick Mortar	42	5,700	Sq.Ft.	Negative
3	Exterior	Exterior Seal Caulk - Black	43	40	Ln.Ft.	Negative
3	Exterior	Exterior Door Frame Caulk - Gray	44	38	Ln.Ft.	Negative
3	Exterior	Exterior Wall Joint Caulk - Cream	45	120	Ln.Ft.	Negative
3	**Exterior**	**Exterior Window Frame Caulk - Cream**	**46**	**150**	**Ln.Ft.**	**Positive**
3	Exterior	Exterior Window Glaze - Cream	47	390	Ln.Ft.	Negative
3	Exterior	Exterior Wall Joint Caulk - Gray	48	130	Ln.Ft.	Negative
3	Exterior	Exterior Window Frame Caulk - Black 2	49	210	Ln.Ft.	Negative
3	Exterior	Exterior Window Glaze - Cream 2	50	315	Ln.Ft.	Negative
3	Exterior	Exterior Door Frame Caulk - Black	51	21	Ln.Ft.	Negative
3	Exterior	Exterior Wall Joint Caulk - Red	52	75	Ln.Ft.	Negative
3	Exterior	Exterior Window Frame Caulk - Dark Gray	53	200	Ln.Ft.	Negative
3	Exterior	Exterior Window Glaze - Black 2	54	100	Ln.Ft.	Negative
3	**Exterior**	**Roof Window Glaze - Black**	**55**	**400**	**Ln.Ft.**	**Positive**
3	Exterior	Roof Window Frame Caulk - Brown	56	400	Ln.Ft.	Negative
3	Exterior	Roof Window Trim - Gray	57	100	Ln.Ft.	Negative
3	Exterior	Roof Window Frame Caulk - Cream	58	200	Ln.Ft.	Negative
3	Exterior	Roof Sandstone Caulk - Cream	59	200	Ln.Ft.	Negative
3	Exterior	Roof Edge Coating - Tan	60	35	Ln.Ft.	Negative
3	**Exterior**	**Roof Window Glaze - Gray**	**61**	**650**	**Ln.Ft.**	**Positive**
3	**Exterior**	**Roof Window Frame Caulk - Tan**	**62**	**400**	**Ln.Ft.**	**Positive**
3	Exterior	Roof Window Frame Caulk - Black	63	400	Ln.Ft.	Negative
3	Exterior	Roof Window Glaze - Cream	64	650	Ln.Ft.	Negative
3	Exterior	Roof Window Frame Caulk - Black 2	65	400	Ln.Ft.	Negative
3	Exterior	Roof Window Glaze - Cream 2	66	500	Ln.Ft.	Negative
3	Exterior	Roof Edge Caulk - Cream	67	100	Ln.Ft.	Negative

CITY OF ANN ARBOR
WATER TREATMENT PLANT
FILTER BUILDING
FUNCTIONAL SPACES



City of Ann Arbor

Water Treatment Plant

Filter Press Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
1	Level Three South Room	Concrete Floor	2	594	Sq.Ft.	Negative
1	Level Three South Room	Cinderblock	4	100	Sq.Ft.	Negative
1	Level Three South Room	Cinderblock Mortar	5	100	Sq.Ft.	Negative
1	**Level Three South Room**	**Fire Door**	**6**	**7**	**Total**	**Assumed**
1	**Level Three South Room**	**Fire Door Frame**	**7**	**4**	**Total**	**Assumed**
1	Level Three South Room	Drywall	11	700	Sq.Ft.	Negative
1	Level Three South Room	Drywall Tape	12	700	Sq.Ft.	Negative
1	Level Three South Room	Drywall Mud	13	700	Sq.Ft.	Negative
1	Level Three South Room	Stone Panel 1	14	100	Sq.Ft.	Negative
1	Level Three South Room	Stone Panel 2	15	300	Sq.Ft.	Negative
1	Level Three South Room	Door Frame Caulk - Cream	16	30	Ln.Ft.	Negative
1	Level Three South Room	Concrete Wall Seam Caulk - Cream	17	45	Ln.Ft.	Negative
1	Level Three South Room	Covebase - Cream	18	50	Ln.Ft.	Negative
1	Level Three South Room	Covebase - Cream Mastic	19	50	Ln.Ft.	Negative
1	Level Three South Room	Duct Sealant - Cream	20	45	Sq.Ft.	Negative
1	Level Three South Room	Concrete Panel Wall	28	250	Sq.Ft.	Negative
2	Level Three North Room	Concrete Floor	2	2,300	Sq.Ft.	Negative
2	Level Three North Room	Cinderblock	4	10	Sq.Ft.	Negative
2	Level Three North Room	Cinderblock Mortar	5	10	Sq.Ft.	Negative
2	**Level Three North Room**	**Fire Door**	**6**	**2**	**Total**	**Assumed**
2	**Level Three North Room**	**Fire Door Frame**	**7**	**2**	**Total**	**Assumed**
2	**Level Three North Room**	**Pipe Gasket**	**8**		**Total**	**Assumed**
2	Level Three North Room	Fiberglass Pipe Insulation	9	85	Ln.Ft.	Negative
2	Level Three North Room	Fiberglass Pipe Fitting Insulation	10	18	Ln.Ft.	Negative
2	Level Three North Room	Drywall	11	1,100	Sq.Ft.	Negative
2	Level Three North Room	Drywall Tape	12	1,100	Sq.Ft.	Negative
2	Level Three North Room	Drywall Mud	13	1,100	Sq.Ft.	Negative
2	Level Three North Room	Stone Panel 1	14	150	Sq.Ft.	Negative
2	Level Three North Room	Stone Panel 2	15	75	Sq.Ft.	Negative
2	Level Three North Room	Concrete Wall Seam Caulk - Cream	17	500	Ln.Ft.	Negative
2	Level Three North Room	Covebase - Cream	18	90	Ln.Ft.	Negative
2	Level Three North Room	Covebase - Cream Mastic	19	90	Ln.Ft.	Negative
2	Level Three North Room	Duct Insulation Foil Wrap	21	200	Sq.Ft.	Negative
2	Level Three North Room	Duct Joint Fabric - Black	22	24	Sq.Ft.	Negative
2	Level Three North Room	Duct Sealant - Gray	23	50	Ln.Ft.	Negative
2	Level Three North Room	Concrete Panel Wall	28	3,000	Sq.Ft.	Negative

City of Ann Arbor

Water Treatment Plant

Filter Press Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
3	Level Two	Concrete Floor	2	2,000	Sq.Ft.	Negative
3	**Level Two**	**Fire Door**	**6**	**4**	**Total**	**Assumed**
3	**Level Two**	**Fire Door Frame**	**7**	**2**	**Total**	**Assumed**
3	**Level Two**	**Pipe Gasket**	**8**		**Total**	**Assumed**
3	Level Two	Drywall	11	400	Sq.Ft.	Negative
3	Level Two	Drywall Tape	12	400	Sq.Ft.	Negative
3	Level Two	Drywall Mud	13	400	Sq.Ft.	Negative
3	Level Two	Concrete Wall Seam Caulk - Cream	17	500	Ln.Ft.	Negative
3	Level Two	I-Beam and Column Trowel-On	24	240	Sq.Ft.	Negative
3	Level Two	Concrete Panel Wall	28	2,700	Sq.Ft.	Negative
4	Level One	Brick	1	400	Sq.Ft.	Negative
4	Level One	Concrete Floor	2	2,000	Sq.Ft.	Negative
4	Level One	Concrete Walls	3	250	Sq.Ft.	Negative
4	Level One	Cinderblock	4	500	Sq.Ft.	Negative
4	Level One	Cinderblock Mortar	5	500	Sq.Ft.	Negative
4	**Level One**	**Fire Door**	**6**	**1**	**Total**	**Assumed**
4	**Level One**	**Fire Door Frame**	**7**	**1**	**Total**	**Assumed**
4	**Level One**	**Pipe Gasket**	**8**		**Total**	**Assumed**
4	Level One	Drywall	11	450	Sq.Ft.	Negative
4	Level One	Drywall Tape	12	450	Sq.Ft.	Negative
4	Level One	Drywall Mud	13	450	Sq.Ft.	Negative
4	Level One	Stone Panel 1	14	200	Sq.Ft.	Negative
4	Level One	I-Beam and Column Trowel-On	24	200	Sq.Ft.	Negative
4	Level One	Brick Mortar	25	400	Sq.Ft.	Negative
4	Level One	Door Frame Caulk - Gray	26	50	Ln.Ft.	Negative
4	Level One	Stone Panel Caulk - Gray	27	45	Ln.Ft.	Negative
4	Level One	Covebase - Rust	29	4	Ln.Ft.	Negative
4	Level One	Covebase - Rust Mastic	30	4	Ln.Ft.	Negative
4	Level One	Window Frame Caulk - Gray	31	50	Ln.Ft.	Negative
4	Level One	Window Glaze - Rubber Black	32	150	Ln.Ft.	Negative
5	Staircase	Brick	1	75	Sq.Ft.	Negative
5	Staircase	Concrete Floor	2	350	Sq.Ft.	Negative
5	Staircase	Cinderblock	4	800	Sq.Ft.	Negative
5	Staircase	Cinderblock Mortar	5	800	Sq.Ft.	Negative
5	Staircase	Drywall	11	2,600	Sq.Ft.	Negative
5	Staircase	Drywall Tape	12	2,600	Sq.Ft.	Negative

City of Ann Arbor

Water Treatment Plant

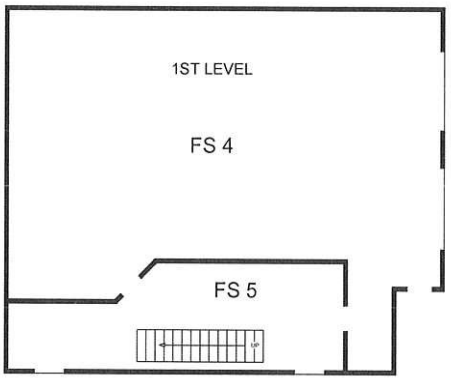
Filter Press Building

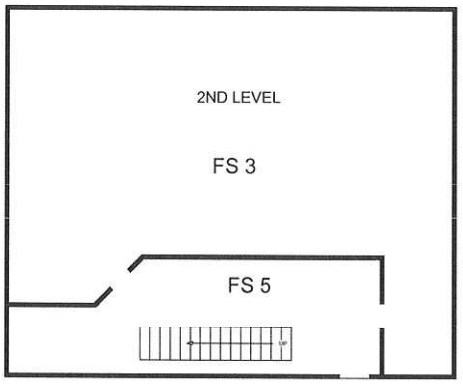
List by Functional Space

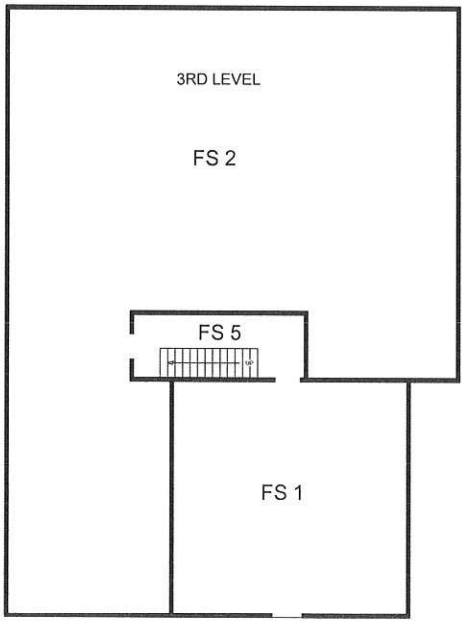
FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
5	Staircase	Drywall Mud	13	2,600	Sq.Ft.	Negative
5	Staircase	Stone Panel 1	14	300	Sq.Ft.	Negative
5	Staircase	Door Frame Caulk - Cream	16	17	Ln.Ft.	Negative
5	Staircase	Covebase - Cream	18	45	Sq.Ft.	Negative
5	Staircase	Covebase - Cream Mastic	19	45	Sq.Ft.	Negative
5	Staircase	I-Beam and Column Trowel-On	24	140	Sq.Ft.	Negative
5	Staircase	Brick Mortar	25	75	Sq.Ft.	Negative
5	Staircase	Stone Panel Caulk - Gray	27	30	Ln.Ft.	Negative
5	Staircase	Covebase - Rust	29	4	Sq.Ft.	Negative
5	Staircase	Covebase - Rust Mastic	30	4	Sq.Ft.	Negative
5	Staircase	I-Beam Caulk - Tan	33	100	Ln.Ft.	Negative
5	Staircase	Covebase - Black	34	20	Sq.Ft.	Negative
5	Staircase	Covebase - Black Mastic	35	20	Sq.Ft.	Negative
6	Exterior	Exterior Brick	36	500	Sq.Ft.	Negative
6	Exterior	Exterior Brick Mortar	37	500	Sq.Ft.	Negative
6	Exterior	Exterior Concrete Wall	38	200	Sq.Ft.	Negative
6	Exterior	Exterior Stone Panel 1	39	2,000	Sq.Ft.	Negative
6	Exterior	Exterior Stone Panel 2	40	4,000	Sq.Ft.	Negative
6	Exterior	Exterior Window Frame Caulk - Gray	41	50	Ln.Ft.	Negative
6	**Exterior**	**Exterior Window Frame Glaze - Gray**	**42**	**150**	**Ln.Ft.**	**Positive**
6	Exterior	Exterior Stone Panel Caulk - Beige	43	3,200	Ln.Ft.	Negative
6	**Exterior**	**Exterior Garage Door Frame Caulk - Gray**	**44**	**80**	**Ln.Ft.**	**Positive**
6	Exterior	Exterior Door Frame Caulk - Cream	45	17	Ln.Ft.	Negative
6	Exterior	Exterior Edge Caulk - Gray	46	150	Ln.Ft.	Negative

CITY OF ANN ARBOR
WATER TREATMENT PLANT
FILTER PRESS BUILDING
FUNCTIONAL SPACES

EXTERIOR = FS 6







City of Ann Arbor

Water Treatment Plant

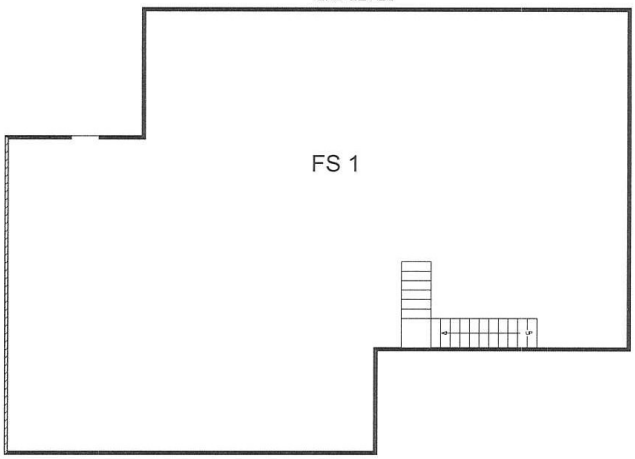
Rapid Mix Building

List by Functional Space

FS#	FS Description	Homogeneous Area Description	HA#	Amount	Units	Asbestos
1	Second Level	Concrete Deck	1	1,539	Sq.Ft.	Negative
1	Second Level	Cinderblock	2	1,200	Sq.Ft.	Negative
1	Second Level	Cinderblock Mortar	3	1,200	Sq.Ft.	Negative
1	Second Level	Concrete Floor	4	1,200	Sq.Ft.	Negative
1	**Second Level**	**Fire Door**	**5**	**2**	**Total**	**Assumed**
1	**Second Level**	**Fire Door Frame**	**6**	**2**	**Total**	**Assumed**
1	Second Level	Door Frame Caulk - Gray	7	42	Ln.Ft.	Negative
1	Second Level	Window Frame Caulk - Cream	8	40	Ln.Ft.	Negative
1	Second Level	Window Glaze - Gray	9	48	Ln.Ft.	Negative
1	Second Level	Concrete Deck Caulk - Cream	10	200	Ln.Ft.	Negative
1	Second Level	Wall Joint Caulk - Gray	11	20	Ln.Ft.	Negative
2	First Level	Concrete Deck	1	2,700	Sq.Ft.	Negative
2	First Level	Cinderblock	2	320	Sq.Ft.	Negative
2	First Level	Cinderblock Mortar	3	320	Sq.Ft.	Negative
2	First Level	Concrete Floor	4	2,700	Sq.Ft.	Negative
2	First Level	Concrete Wall	12	6,000	Sq.Ft.	Negative
2	First Level	Duct Expanson Joint - White	13	8	Sq.Ft.	Negative
2	First Level	Duct Joint Sealant - Dark Gray	14	4	Sq.Ft.	Negative
2	**First Level**	**Pipe Gasket**	**15**			**Assumed**
2	First Level	Fiberglass Pipe Insulation	16	360	Ln.Ft.	Negative
2	First Level	Fiberglass Pipe Fitting Insulation	17	13	Ln.Ft.	Negative
2	**First Level**	**Mud Fittings**	**18**	**17**	**Ln.Ft.**	**Assumed**
2	First Level	Large Concrete Pipe Wrap	19	1,000	Sq.Ft.	Negative
2	First Level	Large Concrete Pipe Collar	20	40	Sq.Ft.	Negative
3	Exterior	Exterior Brick - Red	21	1,650	Sq.Ft.	Negative
3	Exterior	Exterior Brick Mortar	22	1,650	Sq.Ft.	Negative
3	Exterior	Exterior Door Frame Caulk - Gray	23	42	Ln.Ft.	Negative
3	Exterior	Exterior Wall Joint Caulk - Gray	24	15	Ln.Ft.	Negative
3	Exterior	Exterior Concrete	25	200	Sq.Ft.	Negative
3	Exterior	Exterior Window Frame Caulk - Black	26	40	Ln.Ft.	Negative

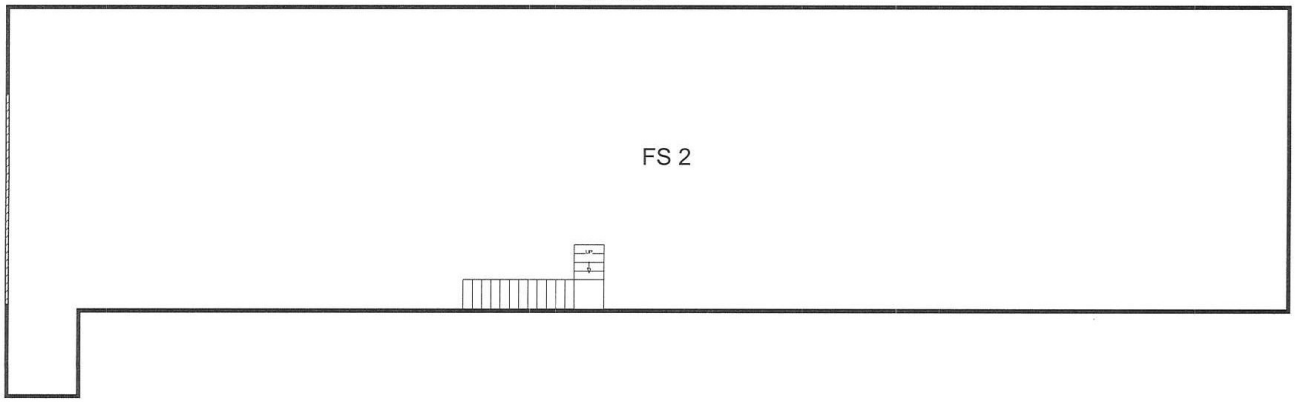
CITY OF ANN ARBOR
WATER TREATMENT PLANT
RAPID MIX BUILDING
FUNCTIONAL SPACES

2ND LEVEL



EXTERIOR = FS 3

1ST LEVEL



ATTACHMENTS

CITY OF ANN ARBOR
PREVAILING WAGE DECLARATION OF COMPLIANCE

The "wage and employment requirements" of Section 1:320 of Chapter 14 of Title I of the Ann Arbor City Code mandates that the city not enter any contract, understanding or other arrangement for a public improvement for or on behalf of the city unless the contract provides that all craftsmen, mechanics and laborers employed directly on the site in connection with said improvements, including said employees of subcontractors, shall receive the prevailing wage for the corresponding classes of craftsmen, mechanics and laborers, as determined by statistics for the Ann Arbor area compiled by the United States Department of Labor. Where the contract and the Ann Arbor City Code are silent as to definitions of terms required in determining contract compliance with regard to prevailing wages, the definitions provided in the Davis-Bacon Act as amended (40 U.S.C. 278-a to 276-a-7) for the terms shall be used. Further, to the extent that any employees of the contractor providing services under this contract are not part of the class of craftsmen, mechanics and laborers who receive a prevailing wage in conformance with section 1:320 of Chapter 14 of Title I of the Code of the City of Ann Arbor, employees shall be paid a prescribed minimum level of compensation (i.e. Living Wage) for the time those employees perform work on the contract in conformance with section 1:815 of Chapter 23 of Title I of the Code of the City of Ann Arbor.

At the request of the city, any contractor or subcontractor shall provide satisfactory proof of compliance with this provision.

The Contractor agrees:

(a) To pay each of its employees whose wage level is required to comply with federal, state or local prevailing wage law, for work covered or funded by this contract with the City,

(b) To require each subcontractor performing work covered or funded by this contract with the City to pay each of its employees the applicable prescribed wage level under the conditions stated in subsection (a) or (b) above.

(c) To provide to the City payroll records or other documentation within ten (10) business days from the receipt of a request by the City.

(d) To permit access to work sites to City representatives for the purposes of monitoring compliance, and investigating complaints or non-compliance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services in accordance with the terms of the wage and employment provisions of the Chapter 14 of the Ann Arbor City Code. The undersigned certifies that he/she has read and is familiar with the terms of Section 1:320 of Chapter 14 of the Ann Arbor City Code and by executing this Declaration of Compliance obligates his/her employer and any subcontractor employed by it to perform work on the contract to the wage and employment requirements stated herein. The undersigned further acknowledges and agrees that if it is found to be in violation of the wage and employment requirements of Section 1:320 of the Chapter 14 of the Ann Arbor City Code it shall has be deemed a material breach of the terms of the contract and grounds for termination of same by the City.

_____
Company Name

_____
Signature of Authorized Representative Date

_____
Print Name and Title

_____
Address, City, State, Zip

_____
Phone/Email address

Questions about this form? Contact Procurement Office City of Ann Arbor Phone: 734/794-6500

CITY OF ANN ARBOR
LIVING WAGE ORDINANCE DECLARATION OF COMPLIANCE

The Ann Arbor Living Wage Ordinance (Section 1:811-1:821 of Chapter 23 of Title I of the Code) requires that an employer who is (a) a contractor providing services to or for the City for a value greater than $10,000 for any twelve-month contract term, or (b) a recipient of federal, state, or local grant funding administered by the City for a value greater than $10,000, or (c) a recipient of financial assistance awarded by the City for a value greater than $10,000, shall pay its employees a prescribed minimum level of compensation (i.e., Living Wage) for the time those employees perform work on the contract or in connection with the grant or financial assistance. The Living Wage must be paid to these employees for the length of the contract/program.

Companies employing fewer than 5 persons and non-profits employing fewer than 10 persons are exempt from compliance with the Living Wage Ordinance. If this exemption applies to your company/non-profit agency please check here [___] *No. of employees__*

The Contractor or Grantee agrees:

(a) To pay each of its employees whose wage level is not required to comply with federal, state or local prevailing wage law, for work covered or funded by a contract with or grant from the City, no less than the Living Wage. The current Living Wage is defined as $13.22/hour for those employers that provide employee health care (as defined in the Ordinance at Section 1:815 Sec. 1 (a)), or no less than $14.75/hour for those employers that do not provide health care. The Contractor or Grantor understands that the Living Wage is adjusted and established annually on April 30 in accordance with the Ordinance and covered employers shall be required to pay the adjusted amount thereafter to be in compliance with Section 1:815(3).

Check the applicable box below which applies to your workforce

[___] Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage without health benefits

[___] Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage with health benefits

(a) To post a notice approved by the City regarding the applicability of the Living Wage Ordinance in every work place or other location in which employees or other persons contracting for employment are working.

(b) To provide to the City payroll records or other documentation within ten (10) business days from the receipt of a request by the City.

(c) To permit access to work sites to City representatives for the purposes of monitoring compliance, and investigating complaints or non-compliance.

(d) To take no action that would reduce the compensation, wages, fringe benefits, or leave available to any employee covered by the Living Wage Ordinance or any person contracted for employment and covered by the Living Wage Ordinance in order to pay the living wage required by the Living Wage Ordinance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services or agrees to accept financial assistance in accordance with the terms of the Living Wage Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Living Wage Ordinance, obligates the Employer/Grantee to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract or grant of financial assistance.

_____	_____
Company Name	Street Address
_____	_____
Signature of Authorized Representative Date	City, State, Zip
_____	_____
Print Name and Title	Phone/Email address

CITY OF ANN ARBOR
LIVING WAGE ORDINANCE

RATE EFFECTIVE APRIL 30, 2018 - ENDING APRIL 29, 2019

$13.22 per hour
If the employer provides health care benefits*

$14.75 per hour
If the employer does **NOT** provide health care benefits*

Employers providing services to or for the City of Ann Arbor or recipients of grants or financial assistance from the City of Ann Arbor for a value of more than $10,000 in a twelve-month period of time must pay those employees performing work on a City of Ann Arbor contract or grant, the above living wage.

ENFORCEMENT

The City of Ann Arbor may recover back wages either administratively or through court action for the employees that have been underpaid in violation of the law. Persons denied payment of the living wage have the right to bring a civil action for damages in addition to any action taken by the City.

Violation of this Ordinance is punishable by fines of not more than $500/violation plus costs, with each day being considered a separate violation. Additionally, the City of Ann Arbor has the right to modify, terminate, cancel or suspend a contract in the event of a violation of the Ordinance.

* Health Care benefits include those paid for by the employer or making an employer contribution toward the purchase of health care. The employee contribution must not exceed $.50 an hour for an average work week; and the employer cost or contribution must equal no less than $1/hr for the average work week.

The Law Requires Employers to Display This Poster Where Employees Can Readily See It.

For Additional Information or to File a Complaint Contact:
Colin Spencer at 734/794-6500 or cspencer@a2gov.org

Revised 2/1/2018

Vendor Conflict of Interest Disclosure Form

All vendors interested in conducting business with the City of Ann Arbor must complete and return the Vendor Conflict of Interest Disclosure Form in order to be eligible to be awarded a contract. Please note that all vendors are subject to comply with the City of Ann Arbor's conflict of interest policies as stated within the certification section below.

If a vendor has a relationship with a City of Ann Arbor official or employee, an immediate family member of a City of Ann Arbor official or employee, the vendor shall disclose the information required below.

1. No City official or employee or City employee's immediate family member has an ownership interest in vendor's company or is deriving personal financial gain from this contract.
2. No retired or separated City official or employee who has been retired or separated from the City for less than one (1) year has an ownership interest in vendor's Company.
3. No City employee is contemporaneously employed or prospectively to be employed with the vendor.
4. Vendor hereby declares it has not and will not provide gifts or hospitality of any dollar value or any other gratuities to any City employee or elected official to obtain or maintain a contract.
5. Please note any exceptions below:

Conflict of Interest Disclosure*	
Name of City of Ann Arbor employees, elected officials or immediate family members with whom there may be a potential conflict of interest.	( ) Relationship to employee _____ ( ) Interest in vendor's company ( ) Other (please describe in box below)

*Disclosing a potential conflict of interest does not disqualify vendors. In the event vendors do not disclose potential conflicts of interest and they are detected by the City, vendor will be exempt from doing business with the City.

I certify that this Conflict of Interest Disclosure has been examined by me and that its contents are true and correct to my knowledge and belief and I have the authority to so certify on behalf of the Vendor by my signature below:		
Vendor Name	**Vendor Phone Number**	
Signature of Vendor Authorized Representative	**Date**	**Printed Name of Vendor Authorized Representative**

Questions about this form? Contact Procurement Office City of Ann Arbor Phone: 734/794-6500, procurement@a2gov.org

CITY OF ANN ARBOR
DECLARATION OF COMPLIANCE

Non-Discrimination Ordinance

The "non discrimination by city contractors" provision of the City of Ann Arbor Non-Discrimination Ordinance (Ann Arbor City Code Chapter 112, Section 9:158) requires all contractors proposing to do business with the City to treat employees in a manner which provides equal employment opportunity and does not discriminate against any of their employees, any City employee working with them, or any applicant for employment on the basis of actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight. It also requires that the contractors include a similar provision in all subcontracts that they execute for City work or programs.

In addition the City Non-Discrimination Ordinance requires that all contractors proposing to do business with the City of Ann Arbor must satisfy the contract compliance administrative policy adopted by the City Administrator. A copy of that policy may be obtained from the Purchasing Manager

The Contractor agrees:

(a) To comply with the terms of the City of Ann Arbor's Non-Discrimination Ordinance and contract compliance administrative policy, including but not limited to an acceptable affirmative action program if applicable.

(b) To post the City of Ann Arbor's Non-Discrimination Ordinance Notice in every work place or other location in which employees or other persons are contracted to provide services under a contract with the City.

(c) To provide documentation within the specified time frame in connection with any workforce verification, compliance review or complaint investigation.

(d) To permit access to employees and work sites to City representatives for the purposes of monitoring compliance, or investigating complaints of non-compliance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services in accordance with the terms of the Ann Arbor Non-Discrimination Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Non-Discrimination Ordinance, obligates the Contractor to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract.

_____
Company Name

_____
Signature of Authorized Representative Date

_____
Print Name and Title

_____
Address, City, State, Zip

_____
Phone/Email Address

Questions about the Notice or the City Administrative Policy, Please contact:
Procurement Office of the City of Ann Arbor
(734) 794-6500

CITY OF ANN ARBOR NON-DISCRIMINATION ORDINANCE

Relevant provisions of Chapter 112, Nondiscrimination, of the Ann Arbor City Code are included below. You can review the entire ordinance at www.a2gov.org/humanrights.

Intent: It is the intent of the city that no individual be denied equal protection of the laws; nor shall any individual be denied the enjoyment of his or her civil or political rights or be discriminated against because of actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight.

Discriminatory Employment Practices: No person shall discriminate in the hire, employment, compensation, work classifications, conditions or terms, promotion or demotion, or termination of employment of any individual. No person shall discriminate in limiting membership, conditions of membership or termination of membership in any labor union or apprenticeship program.

Discriminatory Effects: No person shall adopt, enforce or employ any policy or requirement which has the effect of creating unequal opportunities according to actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight for an individual to obtain housing, employment or public accommodation, except for a bona fide business necessity. Such a necessity does not arise due to a mere inconvenience or because of suspected objection to such a person by neighbors, customers or other persons.

Nondiscrimination by City Contractors: All contractors proposing to do business with the City of Ann Arbor shall satisfy the contract compliance administrative policy adopted by the City Administrator in accordance with the guidelines of this section. All city contractors shall ensure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity and tends to eliminate inequality based upon any classification protected by this chapter. All contractors shall agree not to discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment, or a matter directly or indirectly related to employment, because of any applicable protected classification. All contractors shall be required to post a copy of Ann Arbor's Non-Discrimination Ordinance at all work locations where its employees provide services under a contract with the city.

Complaint Procedure: If any individual believes there has been a violation of this chapter, he/she may file a complaint with the City's Human Rights Commission. The complaint must be filed within 180 calendar days from the date of the individual's knowledge of the allegedly discriminatory action or 180 calendar days from the date when the individual should have known of the allegedly discriminatory action. A complaint that is not filed within this timeframe cannot be considered by the Human Rights Commission. To file a complaint, first complete the complaint form, which is available at www.a2gov.org/humanrights. Then submit it to the Human Rights Commission by e-mail (hrc@a2gov.org), by mail (Ann Arbor Human Rights Commission, PO Box 8647, Ann Arbor, MI 48107), or in person (City Clerk's Office). For further information, please call the commission at 734-794-6141 or e-mail the commission at hrc@a2gov.org.

Private Actions For Damages or Injunctive Relief: To the extent allowed by law, an individual who is the victim of discriminatory action in violation of this chapter may bring a civil action for appropriate injunctive relief or damages or both against the person(s) who acted in violation of this chapter.

THIS IS AN OFFICIAL GOVERNMENT NOTICE AND
MUST BE DISPLAYED WHERE EMPLOYEES CAN READILY SEE IT.

Michigan Department
Of Transportation
CP-347 (04/10)

MICHIGAN DEPARTMENT OF TRANSPORTATION

CERTIFIED PAYROLL

COMPLETION OF CERTIFIED PAYROLL FORM FULFILLS THE MINIMUM MDOT PREVAILING WAGE REQUIREMENTS

(1) NAME OF CONTRACTOR / SUBCONTRACTOR (CIRCLE ONE) (2) ADDRESS

(3) PAYROLL NO. (4) FOR WEEK ENDING (5) PROJECT AND LOCATION (6) CONTRACT ID

(a)	(b)	(c)	(d) DAY AND DATE							(e)	(f)	(g)	(h)	(i)	(j) DEDUCTIONS						(k)
EMPLOYEE INFORMATION	WORK CLASSIFICATION	Hour Type	HOURS WORKED ON PROJECT							TOTAL HOURS ON PROJECT	PROJECT RATE OF PAY	PROJECT RATE OF FRINGE PAY	GROSS PROJECT EARNED / GROSS WEEKLY EARNED	TOTAL WEEKLY HOURS WORKED ALL JOBS	FICA	FEDERAL	STATE		OTHER	TOTAL DEDUCT	TOTAL WEEKLY WAGES PAID FOR ALL JOBS
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											
NAME:										0			$0.00							$0.00	$0.00
ETH/GEN: ID #:	GROUP/CLASS #:	S								0											

Date _____

I, _____ _____
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

_____ on the
(Contractor or Subcontractor)

_____; that during the payroll period commencing on the
(Building or Work)

_____ day of _____, _____, and ending the _____ day of _____, _____,
all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

_____ from the full
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Start. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. § 3145), and described below:

_____

_____

_____

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ – in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ – Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE 31 OF THE UNITED STATES CODE.